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NOTES ON RECENT EXPLORATIONS IN CENTRAL ASIA.

THE publication of a third edition of Colonel Walker's map of Turkistan* affords an opportunity of calling attention to the great strides that have been made in our knowledge of the geography of Central Asia in the two years that have elapsed since the appearance of the second edition. I propose, in the present paper, to notice briefly the additions and rectifications which have been made through the agency of British officers and others, working from the side of India. The greater portion of these have been derived from the labours of the mission to Kashgharia, under Sir Douglas Forsyth, of which I was the geographer; but some very important additions have also been made in the regions of the Upper Oxus, which were being explored at the same time by emissaries of the Indian Trigonometrical Survey. A subsequent exploration was made, by one of the well-known *pandits*, of an entirely new route across Great Tibet, of which a considerable portion, which falls within the limits of the the Turkistan map, is now published.

As full details of the geographical work executed in connection with Sir D. Forsyth's mission will be found in the report thereof, which is now being passed through the press, I only propose to give a summary of the principal results. These are:—

1st. The correct fixing of certain important towns and positions by astronomical observations, and the verification of previous determinations which had been made at some of the same points.

2nd. The survey of about three thousand miles of route lines, a great portion of which is entirely new, while the portions which are not new have been re-surveyed with greater accuracy than was originally possible.

I. As regards the astronomical results I need not here enter at length. At Kashghar I was enabled to obtain very complete sets of observations to the moon for longitude, and the resulting position, viz., long. 76° 6′ 47″ E. of Greenwich, has been used as the origin for all the mapping of Eastern Turkistan. Colonel Scharnhorst, who accompanied the Russian Mission to Kashghar, under General Baron von Kaulbars, in 1872, determined the longitude to be 76° 4′ 42″. The difference of about two miles has to be reduced by two-fifths of a mile to allow for the distance between the respective stations of observation, which lie in almost exactly the same parallel of latitude — for which Scharnhorst's value was 39° 24′ 16″ N.—while my own determination was 39° 24′ 26″. It is most satisfactory to find that the determinations by Russian and British officers are thus almost identical.

An equally satisfactory connection was made to the west with the easternmost point reached by Lieut. Wood in his adventurous journey up the Oxus in 1838—viz., the western extremity of the Victoria Lake in the Great Pámir. My own chronometric observations depending on my astronomical value of Kashghar, give for this point within one minute the same longitude as determined by Lieut. Wood in the survey which he brought up from Kabul—my value being 73° 40′ E. long., and that of Lieut. Wood* 73° 40′ 38″. Our latitudes are identical, viz., 37° 27′ N.

The longitude of Kila Panjah (in Wakhan), the most westerly point visited by the European members of the mission, was determined by three independent methods, viz., by lunar observations, by chronometric measurements from Kashghar, and by connection with the latter place by a route survey. The value finally accepted is 72° 45′ 29″ E. of Greenwich. Its latitude is 37° 0′ 18″ N.

The position assigned to the Yangi-Shahr, or new city of Yarkand, is 38° 25′ N. lat. and 77° 15′ 55″ E. long., values which agree very nearly with those obtained by Mr. Shaw.

II. As regards the route surveys, a great amount of labour was involved in the re-survey of the various roads between Ladakh and Turkistan, *viâ* the Karakorum Pass, and by Changchenmo, and considerable rectifications were found necessary in the country to the north of the Karakorum range, which do not, however, require to be noticed in this place. Amongst the more important routes which it is desirable to make some special mention of we have—

(*a.*) The road from Yarkand to Aktágh viâ Kugiar.
(*b.*) ,, ,, Yarkand to Khotan.
(*c.*) ,, ,, Khotan to Sorgáhk and Noh.
(*d.*) ,, ,, Chehil Gombáz to Yarkand.
(*e.*) ,, ,, Yarkand to Kashghar.

* Map of Turkistan and the countries between the British and the Russian Dominions in Asia—mapped on the basis of the surveys made by British and Russian officers up to 1875—compiled, drawn, and photozincographed in the office of Colonel J. T. Walker, R.E., F.R.S., Superintendent of the Great Trigonometrical Survey of India, June 1875. In four sheets; scale 1 inch = 32 miles.

* See page 232, New Edition of Wood's *Oxus*, with Essay by Colonel Yule.

(*f.*) The road from Kashghar to Chadyr-kul.
(*g.*) ,, ,, Kashghar to the Belowti Pass.
(*h.*) ,, ,, Kashghar to Marálbáshi.
(*k.*) ,, ,, Kashghar to the Pámirs and Kila Panjah.
(*l.*) ,, ,, Tshkashem to Kila Wámeer.

(*a.*) *The road from Yárkand to Aktágh viâ Kugiar.*—A portion of this road, viz., from Aktagh down the Yarkand River to opposite the Yangi-diwan Pass, was explored in former years by Mr. Hayward, but between the Pass and Karghalik we had no correct data on which to construct our maps. A careful route survey has now been made of the whole road, which, although abandoned as a trade route in recent years for fear of robbers, was formerly a portion of the regular winter caravan route between Yarkand and Leh.

(*b.*) *The road from Yarkand viâ Karghálik and Gúma to Khotan* has now been carefully surveyed by one of the Pandits. Our former knowledge of it depended on a hasty reconnaissance of the eastern portion of it by Mr. Johnson on his return journey from Khotan in 1864. The result of the recent survey operations, with reference to the position of Khotan, has been to necessitate an alteration in its longitude of more than half a degree. Its newly-determined position is 80° E. of Greenwich, agreeing much more nearly with that assigned to it in the old Chinese tables (80° 21′ E.) than the position it has recently held in our own maps. The new value agrees well with the position assigned to it by Hayward,* based on its reported distances from Sánju and from Yarkand.

(*c.*). *Khotan to Sorghák and Noh.*—This road was surveyed by one of the Pandits attached to the mission. It passes between 1½° to 2° to the east of the most easterly route between Turkistan and Ladakh hitherto surveyed, *i.e.*, the one by which Mr. Johnson went to Khotan. The road from Noh lies in a north-easterly direction over an elevated plain, varying from 15,000 to 17,000 feet above sea level, crossed here and there by low ridges rising somewhat irregularly from the surface of the plain. In lat. 35° 7′ the road crosses, at a height of but little more than 17,000 feet, the watershed of a snowy range, which is probably the true eastern continuation of the Kuen Luen Mountains; it then descends the Kiria River, in a northerly direction, towards the plains of Turkistan, as far as Arash (16,000 feet), where it again ascends on to a large plain called Ghubolik (17,000 feet), which connects the snowy range just alluded to with another range to the north, which although also covered with snow in July, was not so high as the southern range. This northern ridge forms the northern buttress of the vast Tibetan plateau, and from it flows the Polu stream (a branch of the Kiria River), in descending which to Polu—a distance of about 28 miles, including windings—there is a fall of about 9000 feet. From Khotan, Polu may be reached, either by the direct road (by Chihar Imám) which skirts the feet of spurs from the elevated plateau above, or by Kiria, the route followed by the Pandit, and by which the distance from Khotan is 155 miles. Throughout the whole road from Kiria to Leh fuel was abundant everywhere, and there was only one stage where there was not a good supply of grass. These facts would indicate the line as one well adapted to the native merchant, to whom time is of no great value. As far as can be learned, however, from enquiry, it never has been used as a trade route, at all events on a large scale, owing principally to fear of the Chang-pas or Tagh-lik wandering tribes of Tartars, who sometimes frequent the neighbourhood. These men are nominally subject to the Chinese officials at Garlokh and Rudokh, but practically are only so far subject to them that they would probably abstain from committing violent agression on parties travelling under the protection of those authorities. Near Rikong Chumik were the remains of several huts; others were frequently seen along the line of road, although, fortunately for the Pandit, he did not meet or see a single human being between Ghubolik and Noh, a distance of 244 miles, a circumstance which enabled him to complete his route survey up to Noh without interruption. Further details about this route are given in the published reports of the mission.

(*d.*) *Chehil Gombáz to Yarkand, viâ the Charling River.* This road was surveyed by a Pandit, and is chiefly important as fixing the position of Khusharáb on the Sarikol branch of the Yarkand River. It also diminishes the large unexplored area lying to the north of the Muztágh or Karakorum Range, and to the west of the newly-surveyed Kugiar route.

(*e.*) *Yarkand to Kashghar.* This road had previously been carefully surveyed by Hayward, and the most important addition I am enabled to make is the correct determination of the height of Tagharma Peak, and others of the same range lying to the west of and nearly parallel to our road. Tagharma, the highest of these, I ascertained (by altitudes carefully measured with a theodilite at Yapchan and at Kashgar) to be no less than 25,500 feet above sea level, a somewhat unexpected result, as Hayward had estimated its height at but little more than 21,000 feet. My results, however, confirm those of Fedchenko, who, looking from near the Alai, in the direction of these same mountains, estimated the height of some peaks that he saw at 25,000 feet.

(*f.*) *Kashghar to Chadyrkul.* An account of this road has already appeared in the Geographical Society's *Proceedings* in the shape of a letter written by me to Sir Bartle Frere. I will therefore here merely allude to the circumstance that my survey of this road is the only existing link between the Russian and English Surveys; and it is a curious fact, that when plotting out my work since returning to India—by making use of the Russian astronomically determined latitude of the east end of the lake, to which I had taken a bearing from a point nearly due south—I place the end of the lake in precisely the same longitude as finally determined by the Russians—the small discrepancy existing at Kashghar disappearing altogether on reaching Chadyrkul. It must be stated that both my own and the Russian surveys of this section were very rough, and made under great difficulties.

(*g.*) *The road from Kashghar to the Belowti Pass, on the road to Ush Turfán and Aksú.* I succeeded in making a rough but tolerably accurate survey of this route, based on astronomical observations, and a somewhat detailed description of it is given in the Yarkand reports. The previously existing delinea-

* *Vide R.G.S. Journal* for 1870, page 21.

tions of this road are extremely incorrect, and are derived solely from Klaproth's map of Central Asia, based on the work of the Peking missionaries. My previous visit to Chadyrkul, and a subsequent exploration in the Artysh districts to the north of Kashghar, have made it apparent that that portion of the Thian Shán Mountains lying to the north and north-east of Kashghar, marked on our maps as "the Syrt," and hitherto represented as a high table-land rising immediately above the plains of Turkistan, in reality consists of a series of parallel mountain ranges, running as a rule from west to east,* each range increasing gradually in height from the lowest ridge on the south to the main range on the north—each range also decreasing in height as it runs eastward. Between these ranges, and running parallel to them on extensive level plains, at first very little higher than the plateau of Eastern Turkistan, but also successively rising higher and higher towards the north, while at the same time they slope down towards the east. Thus, the Tughamati Plain, about 45 miles north of Kashghar, is higher by 2000 feet; while the Jai Tupa Plain, about the same distance east of the Tughamati Plain (of which in all probability it is the continuation), is only about 1000 feet higher than Kashghar. These large plains have generally much grass and fuel though but little water. At one of our camps, which was under snow, the Kirghiz who were encamped there, told me that it was only in mid-winter that they could keep their flocks at that particular place—as the snow then lying on the ground served as a substitute for water, which was not obtainable at any other season of the year.

Another important result of this excursion is the alteration that has been necessitated in the positions of Ush Turfán and Áksú—the former of which has been shifted nearly three-quarters of a degree to the east of the place assigned to it in Colonel Walker's map of 1873. This involves a similar alteration as regards Áksú, and it is found that the new position agrees very well with the latest determination of the Russians.

(*h.*) *The road from Kashghar to Marálbáshi on the Aksú road.* The position in longitude of Faizabad, some 30 miles to the east of Kashghar, was determined chronometrically by myself, and the road between that town and Chárwágh, a few miles to the east of Marálbáshi, depends on a reconnaissance made by Captain Biddulph, checked by observations for latitude taken by that officer at Marálbáshi, a place of considerable importance, situated at the junction of the roads from Yarkand and Kashghar to Áksú and the frontier towns of the Amír of Kashghar's dominions. A native agent was subsequently despatched from Kashghar to Áksú, by Sir Douglas Forsyth, and the notes on the road that he brought back have been utilized in making considerable alterations in the course of the Kashghar River between Marálbáshi and Áksú.

(*k.*) *The road from Kashghar to Panjah (in Wakhán).* Our party went to Wakhán by almost the identical route followed in an opposite direction by the "Mirza," in 1869—*i. e.* through Tashkurghán and the Little Pámír. On our return journey we went by the Great Pámír road, which Wood followed in 1838, as far as the west end of Lake Victoria; from that point to Ak-tásh, in the Áksú Valley, we followed a road which has never before been surveyed or described, although Colonel Yule has published an itinerary by Faiz Bux, of a road which lies intermediate between the roads by which we went and returned. Numerous observations for latitude and time have enabled me to lay down the roads through both Pámírs with great precision, and to connect most satisfactorily the routes of Eastern and Western Turkistan. Careful hypsometric observations for determination of height above sea-level were made throughout the journey (as indeed was the case over the whole 3000 miles of route survey before alluded to). My observations give a smaller height for the Victoria Lake, viz., 13,900 feet, than that determined by Wood; while the height I obtain for the lake of Little Pámír, 13,100 feet, is almost identical with that deduced from the Mirza's observations in 1869. Although the Mirza's survey of that portion of the road from Panjah up to the Little Pámír was very good, yet the section between the Pámír and Kashghar has been found to stand in need of considerable revision—a fact by no means to be wondered at, considering the extreme difficulties under which he laboured. One curious mistake was detected, and it is interesting to observe that the discovery had been anticipated by Colonel Yule—*vide* the last page of his introductory essay to Wood's *Oxus*. The stream flowing from the Little Pámír Lake—passing by Ak-tash—where it bears the name of Aksú was ascertained by us to contain the head-waters of the Murghábi River, which, joined by streams from other lakes to the north, is now known to flow into the Panjah River at Kila Wámur. The Mirza had erroneously imagined that the Aksú stream wound its way through the range that lies to the east of Ak-tásh (and considering that the whole country was under ice and snow, and he himself probably half dead from fatigue and cold, he may well be excused the blunder), ultimately finding its way into the Yarkand River. In the map constructed from his work—which has for some years been our only authority for the geography of that portion of Asia—the vicinity of the Little Pámír Lake (which has been erroneously supposed to have a double outlet) was shown as the watershed, between Eastern and Western Turkistan, whereas the true watershed, where crossed by us, was at the Neza-tásh Pass (height 14,920 feet), over the range to the east of Ak-tásh, and about 50 miles to the east of its former erroneous determination.

Amongst other points solved during the excursion to Wakhán is the hitherto doubtful question as to the supposed double exit from the Pámír Lakes. It has now been positively ascertained (although not without considerable difficulty, as will be seen from the detailed reports), that neither of the lakes of Great or Little Pámír have more than one outlet. In the case of the former the water flows west, and in the latter east.

With one exception, circumstances did not permit of any explorations being made off the line of road. This opportunity was given to Captain Biddulph—who, instead of accompanying the main party *viâ* the Great Pámír, returned to Ak-tásh *viâ* the road we had gone; and during a day's halt at Sarhadd, the highest inhabited place of the Wakhán Valley, he made a

* Thus resembling in physical construction other portions of the Thian Shan with which the Russian surveyors have made us familiar.

successful reconnaissance to the Baroghil Pass leading over into the valley of Chitrál.

A good deal of information about the country to the north of our route was obtained from native sources, but unfortunately the Kirghiz who inhabited the Great Pámír at the time of Lieutenant Wood's visit, have long since abandoned the country for more settled tracts to the south of Yarkand. This steppe is now uninhabited, and our Wákhi guides knew but little of the country beyond. What information we were enabled to collect from them, and from some Kirghiz who accompanied us from Kashghar, has been embodied in the map which I prepared to accompany Sir D. Forsyth's reports, in which I have endeavoured to reconcile as far as possible the scanty and often conflicting evidence which we succeeded in obtaining. A study of this map will probably tend to demolish any lingering trust in the celebrated fictitious travels of the anonymous German Baron, that may yet remain in the minds of Russian geographers.

The long contested question as to whether the famous Karakul (or Dragon Lake of the Chinese) drained into the Yarkand or the Oxus Basin has, it is believed, been satisfactorily solved by the identification, as originally surmised by Mr. Shaw, of two lakes bearing the same name. The smaller of these lies nearly due north of Tash Kurghán, and not very far from Hayward's Tagharma Peak. From this little Karakul Lake a river issues, which, flowing through the deep and precipitous Gez defile, emerges in the plains west of Tashbalig and Opál, where, under the name of Yáman-yar, it is said to divide into two principal branches, one of which retains the name Yáwan-yar, while the other is known as the Kusán. These again are subdivided into the numerous branches and canals which cross the road between Yangi Hissar and Kashghar, and have caused so much confusion to geographical students. The larger Lake Karakul is the one that was passed by Abdul Medjid in his journey from India to Khokand, and the balance of much contradictory testimony goes to prove that its waters help to form the Murghábi branch of the Oxus.

(*l.*) *The road from Ishkashim through Gharán and Shighnan to Kila Wamar* is the last piece of work to be noticed in connection with Sir D. Forsyth's mission. My assistant Múnshi Abdul Luthan was detached from our party at Panjah, to make an excursion down the Oxus, which he succeeded in following for 100 miles along that unknown portion of its course which extends from Ishkashim, where the river takes a sudden bend to the north, to Yang-Kila on the frontiers of Koláb, where it has been seen and described by Lieutenant Wood. The most important positions now fixed are Kila Bar-Panjah on the left bank of the river, the chief town of Shighnán; and Kila Wámar, the principal town in Roshan, a dependency of Shighnán. Kila Wámar is on the right bank of the Panjah, just below its junction with the Murghàbi or Bártang River—the river which has already been described as issuing from the lake of Little Pámir, and which subsequently is said to receive the drainage from the lakes of Rang-Kul and Great Karakul. It was crossed by the Múnshi at a distance of about 1000 paces above its junction with the Panjah, and the width of the river bed is described as 1¼ mile, of which at least 1 mile was occupied by water (in May): the stream was in three channels, and the torrent so rapid that many of the horses lost their footing while fording it. In summer it can only be crossed in boats. Its water is red, thick, and muddy, while that of the Panjah is very clear. The volume of water in the Murghábi is considerably larger, and the velocity greater than that of the Panjah. It would appear, therefore, that the latter stream, which has hitherto been considered the main stream of the Oxus, should give the palm to the Murghábi River, which is probably the longest and largest of all the affluents of the Oxus.

Another affluent of the Panjah was observed on its right bank, viz. the Suchán River, which is formed by two large streams, the Shákh-darah and the Ghúnd, which unite about half a mile before falling into the Panjah. Shighnán, including Roshán, is tributary to Badakhshan, and appears to be a country of considerable importance, probably able on an emergency to muster 6000 or 7000 armed men.

I have now to notice the work of the explorer who was employed by the Great Trigonometrical Survey in the regions beyond the Oxus during the same period. This was the well-known "Havildar," who had been employed in conducting an exploration through Dir and Chitrál to Badakhshán in 1870. On the present occasion he went *viâ* Peshawur and Kabul to Badakhshán; but instead of travelling by the well-known Bámian route, he took a new and much more direct line, the greater portion of which had never been previously surveyed. Going north to Chárikár, he crossed the Hindu Kush Range by the Sar-aulang (or Sarolong) Pass, and descending to Khinján, passed along a very direct road by Narin and Ishkamish to Faizabad in Badakhshán. Thence he started on a tour which, with the previously described exploration down the Oxus to Kila Wámar, has entirely altered the appearance on our maps of that hitherto almost unknown portion of Central Asia. Proceeding westward to Rusták he turned north, crossed the Oxus at Samti, where he found the river still called the Panjah. He then visited in succession the towns of Koláb, Khawáling (or Khuwàlin), Sagri-dasht, Kila Khumb (the capital of Darwáz), and Kila Wanj, places of which geographers have long known the names, but have been most doubtful of their absolute or even relative positions. At Kila Khumb the Havildar again struck the Panjah, and his road continued for some 50 miles along the right bank of the river, in the very centre portion of the great bend before alluded to, which has so long been unknown. At Yaz-ghúlam, the frontier village of Darwáz, he was most unfortunately turned back by orders from the ruler of the country. The point he reached is probably not more than one long day's journey from Pigish, the extreme point reached by the Múnshi from the opposite direction, only a few weeks previously, as it subsequently turned out, to the arrival of the Havildar at Yaz-ghulám. The Havildar, ignorant of what had been done by the Múnshi, being most anxious to complete his own work, eventually went round *viâ* Faizabad to Ishkashim, and tried to make a survey down the river to Yaz-ghulám; but he was again stopped, this time at the southern

frontier of Shighnan, the ruler of which country would not permit him to enter it. Thus there is a gap between the explorations of the Havildar and the Munshi, the existence of which is much to be regretted, but it was clearly unavoidable, and happily the missing link is only a short one.

From Yaz-ghulám the Havildar returned to Koláb by his original route. From Koláb he went to Khulm, by the direct road, which lies for the most part to the north of the Oxus. This has turned out to be a most important piece of exploration, as it has not only determined the positions of the towns of Kurghán Tissa and Kubádián, but has been the means of proving that the Surkháb River does not join the Oxus near Koláb, as has long been supposed, but more probably at a point about 80 miles lower down.

The ideas which modern geographers have hitherto entertained regarding the lower course of the Surkháb appear to have been inherited from Macartney, who, in the geographical memoir accompanying the report on Elphinstone's mission to Kábul in 1808, states that "the Surkháb or Karátigin River rises in the Pámír ridge, and after a course of 180 miles empties itself into the Oxus, 30 miles above the Kokcha, on its right bank."

In conformity with these views, the Surkháb has been usually shown hitherto as passing close to Koláb, and joining the Oxus at some distance below that town. The Havildar came across a small river at Koláb, which he was informed joined the Oxus at a short distance to the south; this river, however, was not the Surkháb, but a river rising in the hills some 60 miles to the north of Koláb, and known in its upper course as the Áksú, and lower down as the Koláb River. The Havildar did not strike the Surkháb until he reached a point in lat. 37° 35′ by long. 68° 32′, more than 70 miles to the west of Koláb. It did not occur to him to follow either of these two rivers down to its junction with the Oxus; but there can be little doubt that the points of junction have been given us by Lieut. Wood, in whose map a small stream is made to join the Oxus, a few miles to the north of the confluence of the Kokcha, and another stream is made to join the Oxus a few miles to the west of Hazrat Imám. No name is given to either stream in Wood's map, but Mr. John Walker in his well-known map of Afghanistan (1844 corrected to 1857), names the eastern one the Surkháb, and the western one the Wagish. Where he got these names from is unknown to me; most probably that of the eastern stream from Macartney, and that of the western one from Wood. Now the Havildar reports that the Surkháb River is more generally known as the Wáksh than the Surkháb, in its lower course; his map shows that where he crossed the Wáksh it was trending southwards, in the direction of the junction of Mr. John Walker's Wagish with the Oxus; and this circumstance, with the similarity of the names, appears conclusively to prove the identity of the rivers Wáksh and Wagish, and to indicate positively the point of junction of the Surkháb with the Oxus.

Geographers have always felt a difficulty, regarding the originally adopted point of junction, that Wood should have known nothing about it, though he was believed to have been so close to it; and Colonel Yule, in his preliminary essay to *Cathay*, actually abandoned that point in favour of what is now shown to be the correct junction; but he did so with considerable misgivings, and mainly on the grounds that his hypothesis had "at least the advantage of not flying in the face of an honest and able traveller." Subsequently, however, he became a convert to the original view of the matter, and in his preliminary essay to the second edition of Wood's *Oxus*, he says, "It has been the fashion in modern maps to represent the junction of the Surkháb with the Panjah, as occurring a few miles to the north of the confluence of the Kokcha . . . . .; there can be little doubt that the real confluence is where Macartney's map placed it, viz., at least 30 miles above the Kokcha junction, considerably to the north of Saiad, and beyond the utmost reach of Wood's ride, in the vicinity of a place called Kinghán Tapah." The Surkháb actually does fall into the Oxus near Kinghán Tapah (or Tipa), and that place turns out to be 50 miles to the west of the position given to it in Colonel Yule's last map.

In the new edition of Colonel Walker's map the junction of the river of Karátigin, or Kizil-su or Surkháb, or Wáksh, with the Panjah, is made to take the place of Mr. Walker's Wagish—and the Áksú or river of Koláb is made to follow the course of Wood's nameless tributary near Saiad.

From Khulm the Havildar went to Ishkashim, as before narrated, and failing in his endeavours to get through Shighnán, returned to India *viâ* Kábul and the Bamian route.

The survey of the Havildar has given us fairly approximate positions for the points visited by him, and has enabled me, at Colonel Walker's request, to utilize and combine the details furnished in the well-known accounts of the routes of Abdul Medjid and Sultan Muhammad—as well as the information contained in General Abramof's account of Karátigin and in M. Fedchenko's more recently published maps and memoirs. The delineation of Karátigin is entirely derived from these sources, taken in combination with the altered position that has been given to the lower portion of the course of the Wáksh or river of Karátigin. Although there are numerous inconsistencies in all these data—even in some instances between the letter-press and map of M. Fedchenko—I trust that the delineation which I have adopted, after numerous discussions with Colonel Walker, will be found to be fairly reliable.

Considerable alterations will also be found in the map of the country lying to the north and north-west of Khulm. I have endeavoured to utilize all existing information about those parts, from Russian maps as well as from various itineraries to which I have had access, but the few accounts we have of the routes between Shahr-i-Sabz, Hissar, and Karátigin are so meagre and inconsistent that it is impossible to combine them in a thoroughly satisfactory manner.

Another exploration, the results of which find a place in Colonel Walker's map, was made by a "Mullah," an assistant of the Havildar, by whom he was left at Jalálábad with instructions to make his way up the Kunar River—from its junction with the Kabul River to its head in the Baroghil Pass—whence he was to find his way back to India *viâ* Yarkand and Ladakh. The Mullah ascended the river as far as

Asmár, whose chief he found engaged in hostilities with the Káfir tribes that inhabit the country on the banks of the river above Asmár; so he had to leave the river and make his way across country to Dir; thence he went to Chitrál by the same route followed by the Havildar on a former occasion; rejoining the river near Darosh. From Chitrál he travelled over new ground, following the river up to its source, and fixing the positions of the town of Mastúj and of various other places on his line of route. He crossed the Baroghil Pass at the head of the Chitrál Valley and then descended to Sarhadd Wakhan, where he joined on to my own line of route-survey between Kashgar and Panjah. His survey has shown that some alterations are necessary in the positions of Dir and Chitrál as previously determined from the Havildar's work.

A very important exploration has been made in Great Tibet by Major Montgomerie's original Pandit, the account of whose journey to Lhasa in 1866 is well known to geographers. He started from Leh after the return of Sir Douglas Forsyth's Mission (to which he had been attached), and proceeding by a very direct road, much to the north of any that has hitherto been traversed by our Pandits, he reached the Namcho or Tengri-nur Lake, the successful exploration of which by another Pandit has very recently been described.* From Namcho Lake he proceeded to Lhasa, and thence made his way to India by a more easterly route than any we were previously acquainted with. When at about 40 miles east of Lhasa, he followed the Brahmaputra River for a short distance, and was enabled to fix approximately its course for a hundred miles still further to the east.† He traversed the Tibetan district of Tawang, and emerged in British territory at Údalgíri in the Durrung district of Assam, having made a very careful route-survey over almost entirely new ground for a distance of 917 miles between Noh and Lhasa, and 306 miles from Lhasa to Udalgíri. Excellent astronomical observations (for latitude) were made throughout his journey, and the quality of his work has been proved to be first rate. The difference in longitude between Lhasa and Udalgíri being little more than a degree, and the position of Udalgíri being well known, the value of the longitude of Lhasa, as determined from the Pandit's route-survey between these two places, viz., 91° 5′ 30″, ought to supersede all former determinations.

Detailed reports of the explorations of the Havildar, the Mullah, and the Pandit are now being prepared, and ought to prove extremely interesting. They will probably be published with the Great Trigonometrical Survey Annual Report for 1874-75.

HENRY TROTTER,
Capt'n R.E.

MUFOORIE, INDIA,
28th June, 1875.

* *Vide* Great Trigonometrical Survey Report for 1873-74; also *Geographical Magazine* for February, 1875.

† By taking bearings to peaks beyond which the river was said to flow.

THE AMU DARYA EXPEDITION.

THE Russian expedition against Khiva in 1873 appeared to afford an excellent opportunity for exploring the ancient bed of the Amu Darya. M. A. Y. Glukhovski and M. M. N. Bogdanof consequently proposed to the Russian Geographical Society to fit out a scientific expedition for that purpose. The exploration of the old bed of the Amu Darya had already been mooted in 1864, but at that time the Russians had no settlement on the eastern shore of the Caspian which might serve as a base of operations, and political conjunctions were far from favourable. In 1870, after the occupation of Krasnovodsk, Messrs. Radde and Sievers were able to start a private expedition, but their labours, as well as those of Stebnitzki, in 1871-1872, did not extend beyond the wells of Igdy. The commission of the Society desired that the expedition should extend its operations over the whole region lying between the Syr Darya and the supposed former mouth of the Oxus into the Caspian; but General Kaufmann, the Governor-General of Turkistan, was not in a position to approve of so extensive a scheme, and merely sanctioned the exploration of the districts held by Russia. The expedition, as finally started, included four sections, viz., surveys, meteorology, ethnography, and natural history. Colonel Stolyetof was entrusted with the command of the expedition; Professor N. P. Barbot de Marny joined it as geologist, and Major Herbert Wood R.E., as volunteer. The meteorological observations were made by Messrs. Dorandt and Hilberg. The following is a *résumé* of the work performed by the expedition:—

TOPOGRAPHICAL SURVEYS.

An area of about 3000 square versts was surveyed, including a large portion of the delta of the Amu Darya and that river as far as Meshekli on the frontiers of Bokhara, and the difference of level between the Syr and Amu, and between Nukus and Lake Aral was determined. The extent of the lines along which altitudes were determined amounted to nearly 1300 versts. Nukus is at an elevation of 60 feet above Lake Aral; the Amu Darya at Tuya-Boyun, near the frontier of Bokhara, is 206 feet above the lake, and the fork of the Syr and Yani Darya 296 feet. These determinations were made with great care, and they show that the delta slopes gently towards the *east*. Lake Dau-Kara occupies the most considerable depression of the whole district: this accounts for the eastern arm of the Amu Darya being better adapted for navigation than the western. The levels between the Syr and Amu showed very clearly that it would be possible to conduct the waters of the former into the dry river-bed Yani Darya. Dau-Kara is about 210 feet below Perovski, and the slope throughout is continuous. Some interesting data on the periodical disappearance of the Yani Darya was collected. In the last century that river, known also as the Yinkar Darya, branched off from the Syr 15 versts below Julek, and separated into two arms to the south-west of it. One of these arms reached the Dau-Kara: the other, known as the Kichkine Darya, flowed towards the north-west, and entered the Aral. The bed of the latter has been filled up in many places by sand-drifts. In former times the Yinkar Darya fed many canals, the traces of which are still to be dis-

covered in the Kizil Kum desert. The ruins discovered along this river proved satisfactorily that there existed here a settled population of a high degree of culture. At that time the Kara Uzyak, an island between Perovski and Karmakchi, was a lake, which received the superabundant waters of the Syr, through a narrow arm, which branched off from the modern river at Perovski. The communication between that lake and the Syr, at Fort No. 2 (Karmakchi), was brought about only about one hundred years ago, when the inhabitants dug a canal for the purpose of irrigating their fields. In the beginning of the present century the Kokanzis constructed a dam across the Yinkar Darya, at Bok-Tyulen, near Perovski, in order to prevent the Kirghiz subjects from visiting Khiva, and since that time the Syr overflowed the country surrounding the lake, and the banks of the Yinkar Darya were converted into a wilderness, resembling that existing between Sary Kamych and Kuna Urgenj. About twenty or thirty years after the construction of this dam, the Kokanzis had made friends with the Khivans, and they then re-directed the waters of the Syr into the dry river-bed. They did this at Ak-Mechet, which is above Bok-Tyulen, and thus gave rise to the Yani Darya, or "new river." But as a portion of the waters of the Syr had found their way into the Kara Uzyak by that time, the quantity of water which entered the Yani Darya was reduced to that extent, and proved sufficient merely to reach the lakes Akcha Kul and Kucha Tengiz, which are dried up at present, but not the Dau-Kara or Lake Aral. This explains the disappearance and reappearance of a large river, which Meiendorff witnessed during his two journeys to Bokhara. About twelve or fifteen years after the period referred to above, the inhabitants of the district of Perovski constructed dams across the Yani Darya, close to where it forks off from the Syr, and thus, for the second time, converted the country along its banks into a desert. The natives living along the Syr are unanimous in their opinion that the volume of the river has decreased visibly during the last thirty or forty years, and they account for this decrease by the canals of irrigation fed from it in the Khanat of Kokand. These facts are of some interest, for they illustrate the manner in which the physical features of a country may be changed through human agency.

The hydrographical features of the delta, including its lakes, as well as the Dau-Kara and Yani-su, were carefully examined. There can be no doubt that the natives are right when they assert that previously to the construction of a dam across the Laudan arm of the Amu, the delta had a very different appearance. At that time the centre of the present delta, which now consists of a swamp, covered partly with reeds, was occupied by numerous islands, rising more or less above the surface, and having a trough-like configuration. These islands had a settled population who cultivated rice. The abundant supply of water, and the small elevation of these islands facilitated the irrigation of the fields. The dam thrown across the Laudan naturally caused a greater volume of water to flow to the delta than formerly, and the islands were destroyed. At the same time the Kuvanj-Yarma and Yani-su branches of the Amu, which were only inconsiderable streams formerly, increased much in size, and the dam which Admiral Butakof saw on the latter has now been entirely washed away. The Ulkun Darya, or western arm, has become shallower, and the difficulties of its navigation induced the members of the expedition to search for a more suitable channel. This they found in the Yani-su.

The volume of water of the river was ascertained in various localities. At Tyuya-Boyun, above the delta, the volume varies between 120,000 and 160,000 cubic feet per second, that is to say, it is more than 50 per cent. more than that discharged by the Neva, and conveys some idea of the size of this great Asiatic river.

A steamer may easily ascend the Amu, though its current is strong and the navigable channel is subject to frequent changes. The depth of the water is sufficient throughout, there are no reefs, and vessels would be able, in most instances, to approach close to the banks of the river.

The whole of these surveys and examinations were carried on under the immediate supervision of Colonel Stolyetof, who was assisted by Messrs. Zubof, Bryukhof, and Shebashef of the Aral flotilla, and by Major Herbert Wood.

The meteorological observations were conducted most indefatigably, under the direction of Mr. F. B. Dorandt. Immediately on his arrival a physical observatory was constructed at Nukus, and a station at Petro-Alexandrovsk. Regular observations were begun on the 1st of July, and they will be continued during a year. Mr. Wilberg and non-commissioned officers take part in this branch of inquiry. The observations extend to temperature and pressure of air, moisture, direction and strength of wind, evaporation, precipitation, temperature of the soil, &c. Magnetical observations have been made at Kazalinsk, Nukus, and Petro-Alexandrovsk.

The climate of Khiva is said to be healthy and agreeable. During the whole of summer the temperature exceeds 30° C. only on two days. The autumn, up to the 1st of December, proved particularly pleasant.

The geological explorations were conducted by Professor Barbot de Marny, and extended over the whole of the newly-acquired territory. He first examined the Kashkana Tau in the Amu Delta, then the banks of that river up to the frontier of Bokhara, and subsequently the Sheikh Jeili Range and its ramifications on Lake Khojikul. Having done this he examined the Kizil Kum Desert, to the north of the Amu, and the various mountain ridges scattered over it, such as the Bukan Tau, Tamdyn Tau, Murun Tau, &c., reaching finally the Nuratanyn Kara and Ak Tau, and the city of Samarkand. These explorations showed that most of the sedimentary rocks are of cretaceous age. This result altogether upsets our present notions respecting the geology of the Amu Delta, for they prove that these territories, during the most recent tertiary epoch, were not covered by the sea, but consisted of dry land. White chalk was found, however, at one spot only, the prevailing rocks of cretaceous age consisting of sand and sandstones. These latter, not being bound together by vegetation, supply the steppe winds the material for the sand ridges, known by the name of Barkhan. The heaping up of these sandhills takes place before the eyes of the traveller, and no hypothesis at all is required to account for their existence.

An examination of the isolated hill ranges in the

steppes, which were hardly known by name only a short time ago, proved equally interesting. These consist of metamorphic rocks, principally crystalline slates and limestones, containing no fossils. Eruptive rocks (granite and others) occur only rarely and in small masses, and are found hardly anywhere except in the Sheikh Jeili and Bukan Tau.

No carboniferous rocks of any kind have been discovered, nor lignite or brown coal. The dykes of quartz which are frequent in the crystalline slates of Sheikh Jeili and Bukan Tau, hardly contain a trace of ores. But even if metals should be discovered in large quantities, it would hardly be possible to work them, as there exists no fuel. The only useful minerals discovered in the newly-acquired territory consist of building stones (particularly marble, which occurs in all the hills) and phosphorites. The latter were first discovered by Professor Barbot de Marny, and are used for the manufacture of mineral manure. Almandine and beryls have been found in the Sheikh Jeili Hills, but the specimens discovered hitherto are only of small value.

During the first period of the expedition, M. A. Severtzof, accompanied by S. M. Smirnof, journeyed along the shore of Lake Aral from Kazalinsk to Nukus. This journey showed that the eastern shore of the lake had undergone many changes, within recent years, owing to the sinking of the water. Bays, which in former times reached far into the land, now consist of dry land; sandbanks have been converted into islands, islands into peninsulas. The ancient shores can still be traced by means of their vegetation.

M. S. M. Smirnof explored the flora of the country, and directed his particular attention to the distribution of parasitic fungi. He is of opinion that the poor vegetation of the Aralo-Caspian region is due not only to the unfavourable climate, but likewise to the pernicious influence of these parasitic fungi, which stifle plants. M. Smirnof is already favourably known through his former labours on the vegetation of the Steppes, and his recent researches on the Amu will no doubt prove valuable additions to botanical science.

The ethnographical and statistical section of the expedition consisted of four members. Colonel L. N. Sobolyef directed his attention principally to the statistics of the population, commerce, and agriculture. He likewise bestowed some attention to the historical monuments still existing in the ruined town. Prince Riza-Kuli-Mirza, a Persian, who had joined the expedition merely in order to advance science, rendered himself exceedingly useful to all the members of the expedition through his knowledge of all oriental languages. M. Alexander made a list of all places and camps within the Amu Darya District, and collected information with respect to them. He likewise studied the language of the inhabitants of the Delta. The artist of the expedition, M. N. N. Karazin, filled his portfolio with interesting sketches.

This short sketch shows that the Amu Darya expedition has performed its task in a successful manner. This success is due, in a large measure, to the support of the local authorities, and particularly to that of the Governor-General of Turkistan, General von Kaufmann.

RECENT JOURNEYS IN PARAGUAY.*

THE country of Paraguay has a certain interest for Englishmen, for Sebastian Cabot, who discovered it more than three hundred years ago, was a native of Bristol. He ascended the Plata and the Paraguay, and, after some encounters with the Indians, returned to Spain in 1530. He was succeeded by many other adventurous spirits, one of whom, Cabeza de Vaca, made a most remarkable and difficult journey from the Brazilian coast to Asuncion, a total distance of 600 miles. To the Jesuit Fathers in Paraguay, as in the Chinese Empire, most of our early geographical knowledge is due: they were, however, subject to continual persecutions, and found firmest ground in the south of the country, till their final expulsion from all Spanish possessions in 1768.

Not long after this event, the disputed and uncertain limits of the possessions of Spain and Portugal in South America, were decided by the treaty of St. Idelfonse, and a Commission was appointed in 1780 to go out to define this boundary on the actual ground.

One of the Commisioners employed in this service was Don Felix de Azara, an officer of the Spanish engineer corps, a native of Barbunales in Arragon, who after the completion of the survey of the boundary line, conceived the project of mapping out the whole country of Paraguay. In carrying out this great work he remained for 13 years in Paraguay, and appears to have travelled over the greater part of its extent, determining the astronomical positions of many points, and gathering the materials for his great work, which is still the standard authority, not only for the geography but also on the natural history of this region, and upon which all subsequent works are based.† Azara returned to Europe in 1801.

It was during the presidency of the elder, or Don Carlos Lopez, from 1842 to 1862, that the first careful survey of the rivers Paraná and Paraguay was made. Owing to the ambition of the younger Lopez, the country was involved in a disastrous seven years' war till his death in 1870. In 1871 the remnant of the Paraguayans formed a Congress and Government with the hope of restoring the ruined prosperity of the country. It was at this time that the loans were obtained from England the history of which is so notorious. In the

* A paper read at the Bristol meeting of the British Association. The historical notice is given in abstract.

† Azara, Felix de: *Voyages dans l'Amerique Meridional.* Paris, 1809. I would call the attention of geographers to a MS. volume by Azara, in possession of the Royal Geographical Society, entitled "Descripcion de la Provincia del Paraguay Conquista," and dated 1792: which contains, besides the positions of the villages given in the French work, and some more detailed geographical descriptions, a list of not less than 166 astronomical positions of hills, river fords, and estrancia houses in Paraguay. I do not expect that the whole of these are points at which special observations for latitude and longitude have been made, but in the case of those which I have been able to examine, the positions are wonderfully accurate. In the map accompanying this paper I have adopted the longitude 57° 40′ W. Gr. for Asuncion, in preference to that given by Page (57° 42′ 42″); this is the longitude given by a recent Brazilian determination, and agrees closely with that of Azara, which he says was obtained by many immersions and emersions of Jupiter's satellites, eclipses of the sun, and occultations of the moon; in the French edition of his work the longitude is set down at 57° 40′ 55″ W. Gr., but the MS., to which I have referred, gives 57° 39′ 47″ W.

58°

57°

22°

25°

24°

26°

CHACO
(From Rio Pilcomayo to Bolivian frontier, under arbitration between Argentine Rep.c & Paraguay)

LENGUAS

TOBAS

ELTOBA
(Argentine Republic)

Cerro Carumbé

Rio Apa

Cº Margarita

Rio de la Paz

Galvan

Rio Bariri - Mbaeri o Ytapesi

Peña horadada

Ytá-pucú-mi

Villa de Salvador

Campo Bellavista

Gavilancué

Terraplén

Sorat

Est.ª Observacion

Casalgué

Agüero-cue

Savaloy

Potrero-mi

Rio Aquidaban

Paso Barreto

Ybapobó Mbotú

Caiguata

Rio Verde

Tuti-y Soja

Naranja-ty

CONCEPCION

Guarambaré

Tacuaty

Rio Ypane

Yabebiri

Tacuara

Corrito

Belascué

Estero Pindo-rendi

Aguaray-mi

Morales

Nanduvusú

Paso Estrella

Lima

SAN PEDRO

Rio Jejui

Yerbales

Yerbi

Rio Quarepoti

Cañada Pirayú

Ybobi

Rosario (Quarepoti)

Ybyrá-y

Ytacurubi

La Carolina

Tayvacuá-y

Sª Estanislada (Santa-mi)

Arce-cue

Capiibobi

Lag.ª Aguaracatý

Tacuary

L. Nara

La merced

Catigua

Manduvirá

Rio Pilcomayo

Ytacurubi (Olivares)

Duarte

Cº Campo limpio

Pirebebuy

Cº Aparipi

Yhú

Carafuntaý

Tobatiri

Rio Negro

Lag.ª Piró

Ajos

Arroyos

Hacurubi

Sª José

Valenzuela

Paso Monje

Hiati

Ybitimi

Duarte

VILLA RICA

Capilla Borja (Yaca-guasú)

Quiindi

Ybycuí

Quiquio

Caazapá

Sta Ana

Mbuyapei

Villa Franca

Aquino

Rio Tebicuá-ri

Paso Portillo

Lag.ª Comba

San Juan (Capillita)

Paso San Fernando

Yacaré

Guaçu-cuá

Estero Cambá

Rio Verde

Rio Paraguay

Sanjita

Oliva

Laguna Ypoá

Mercedes

Piray

Tabapi

Surubiy

Jaguaguatý

Villeta

Ytá

Ybycuí

Tebicuá-mi

Sta María de Fe

A Sketch Map of PARAGUAY

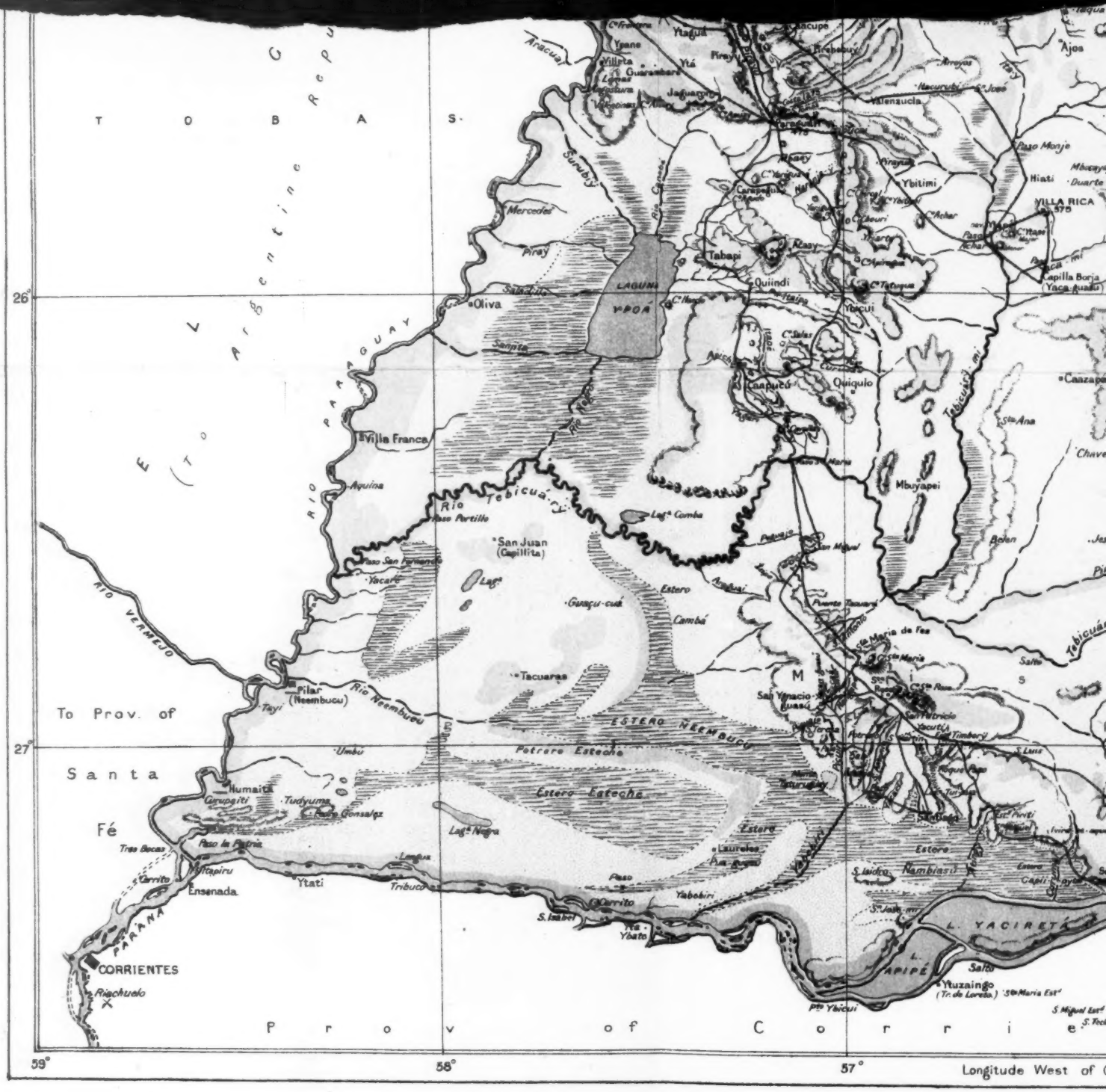
compiled from
the works of AZARA, PAGE, DUGRATY,
MOUCHEZ and WISNER
and from personal observations
by KEITH JOHNSTON,
in 1874-5.

ENGLISH STAT. MILES.
10 5 0 10 20 30
PARAGUAYAN LEAGUES (5000 YARDS)
10 5 0 10

PARAGUAYAN FRONTIER
K. JOHNSTON'S ROUTE
APPROXIMATE EXTENT OF FOREST.
" " PASTURE.

56° 55° 22° 23° 24° 25° 26°

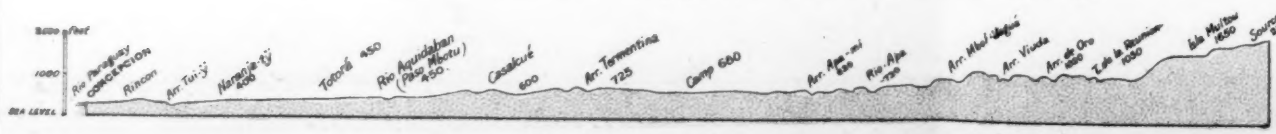
Apa
Boundary mark
Estrella
Dourados
Colonia Dourados
Onça
Amambaya
Cerro Tranquerita
Tatayba
Mangrullo 1850
Cerro Corá
Yerbales
Aquidaban
Yerbales de Concepcion
Verde
Ygatimi
Boundary mark
Aguaray guasú
Yerbales
Curupultura
Ybycuí
Ygatimi
Piraju-y
Canendiyú
Salto Guairá
Site of Ciudad Real (Guairá)
Salto Guairá or Siete Quedas
Villa Ygatimi (Foreden)
Jejuí-mi
Jejuí-guasú
Curuguati
Carimbata
Monte Mbotiha
Rio Ytaimbé
S. Teresa
Rio Ybirá-rantimá
Jaguarý
Jaca-guasú
Ytacorá
Ybyticuacy
Jejuy
Jejuy-guasú
Ytaquá
Ybycuatuy?
Ytuxuará
Ycocay
Tacurú-pucú
Naumbý
Rio Acaray
Yerbales de Caaguasú
Yta-pucú
Rio Munda-y
Salto (66ft)
Curiytiba
Ybytyruzú
Capilla
Pirapitaí (Villa de Jesus)
Aguarý-guasú
Ypé-guasú
Piray-guasú
Rio Aguaray-guasú
Guirapá
Yasoy
Tembé
Yaguí
Pirapó
Caaguasú
Yerbal de Ybiralti
Yerbal de Caaguá
Yerbal de Tacurupucú
Caaguasú
Yhú
Joaquin
Yuquyry
Caraya
Taqua cora
Ajos
Oviedo
Mbocayati
Duarte
Cordillera de Villa Rica
Ybitimi Pico
Villa Rica
Caazapá
Chaves
Reduction
Jesus Maria
Yuti
Pirapó
Tebicuáry-guasú
Cordillera de Caaguasú
Cordillera de Caaguasú
Rio Paraná
Rio Paraguay
Gran Chaco
Paraguay
Argentine Confederation

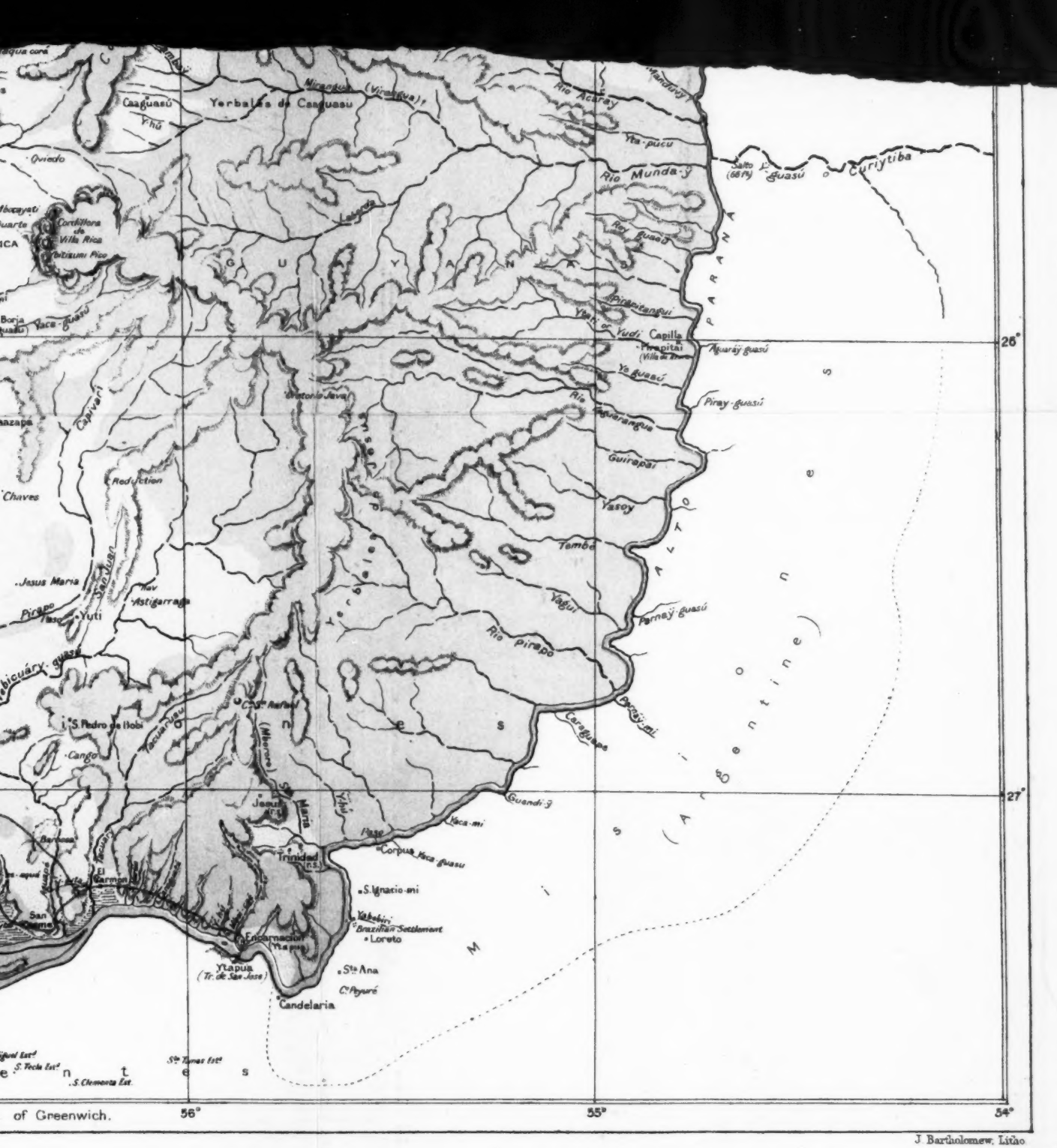


BAROMETRIC SECTIONS IN NORTH

From Rio Paraguay to summit of Plateau of Amambaya, across valleys of Aquidaban and upper Apa.

Water parting of Plate



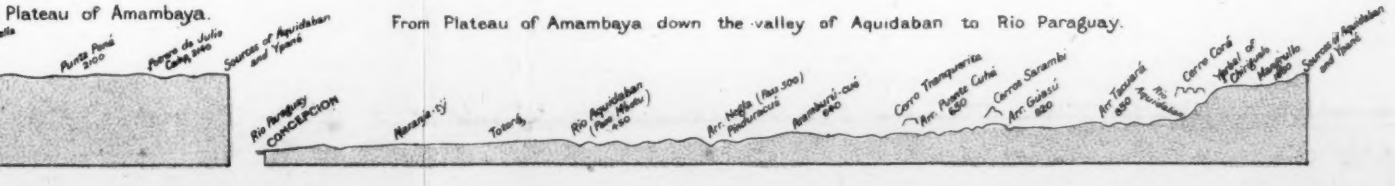


J. Bartholomew, Litho.

ORTHERN PARAGUAY.

Plateau of Amambaya.

From Plateau of Amambaya down the valley of Aquidaban to Rio Paraguay.



despatched here for the supply of the capital and its vicinity. The Salado Valley with the beautiful lake of Ypacaray affords a series of fine pictures. The slopes on each side of it are wooded, and the lower valley of the Salado is filled with a palm forest, but the banks of the lake and the valley of the Piraju have some rich levels of pasture land. A good deal of maize and mandioca are cultivated in patches along the bed of the valley and sometimes the railway passes through long groves of orange-trees, covered with fruit. Luque, Aregua, and Piraju are little villages along the valley, all of one pattern—a square of low, deep-roofed houses, with the church in the midst. Looking into any of them before or after the long midday siesta, when all is quiet, as at midnight, one would certainly see the women busy about the housework, pounding corn, perhaps, in the universal wooden mortar; the few men, with chairs tilted to the wall of the corridor, smoking or taking endless matés

Paraguari is perhaps the most pleasantly situated village of Eastern Paraguay. It lies on the eastern extremity of the plateau of Asuncion, immediately above a level pass which leads from the Salado Valley into a vast level grass plain which stretches away south and east to the Cerros of Acaay. Immediately opposite the village are the Cerro Santo Tomas and Cerro Costa, both covered thickly with wood: the latter has a fine rock peak and precipitous face. Several high, conical hills of wonderfully regular form are seen rising directly from the level plain in the south-east. Paraguari has two chief squares, and its population reaches about 600. As it is the meeting point of all tracks converging from South-Eastern Paraguay towards the capital, it has considerable importance, and, besides its own immediate traffic, it receives a fair amount of transit business, supporting two posadas, while in Asuncion there is only one.

In the outward journey to the Missions we took a south-eastern track towards the village of Ybicui, and for the greater part of the first two days our way led over the great plain of Paraguari. Outside the immediate vicinity of Asuncion there is no road in the sense of an artificially made highway; the whole of the tracks through the country are simply the vague markings worn by former travellers. Here and there in more prosperous times bridges had been made across the smaller streams, but by far the greater number of these have now fallen into decay, and their ruins often render the crossings more difficult than they would otherwise be. Our first experience of passing a large stream was at the Arroyo Mbaey, a chief tributary of the Canabé. We found it too deep to give footing to the oxen, and a delay of several hours was necessary to pass over the contents of the carreta in rough floats made by tying up the corners of a hide. The night was passed in a decayed rancho at some distance from the track.

The Naranja-y is also a considerable stream, deep and slow. Cerro San Rafael, beyond this arroyo, is a round wooded hill, but small in comparison with the two perfect cones of Yarigua-á and-Mi, which rise right and left of it at some distance.

Passing the Canabé, not far from its head, the base of the ridge which bounds the plain, was reached at Costa Peña, where is the home of Señor Duarte, a veteran Paraguayan, who owns the grazing-land between this and the nearest Cerro Yarigua, and the only herd of cattle we had yet seen settled in the country.

Going on towards Ybicui, the road skirts the base of the wooded hills which rise eastward, and then crosses a low ridge which seems to connect these heights with the base of the knot of Acaay; a flat grassy space between two wooded ridges is then reached, and afterwards nearly a mile of the track is through "banado" or reedy marsh, the water rising sometimes to the horse-girths. Along this line the finely wooded peak of Cerro Tatuqua is always conspicuous. Crossing the arroyo of Ybicui, and ascending the opposite slope, the village of that name is reached. This is also built in two squares, the chief one surrounding the little church. After presenting our passports to the "jues" or second dignitary of the village, in absence of the chief, and receiving his simple hospitality, we went on the track for Caapucu. The land beyond Ybicui is a high, rolling heath. Before reaching the arroyo Itaipa, we noticed several long lines of granite boulders lying on the slopes and knolls, extending in the direction N.N.W. to S.S.E. Some of these were of very large size, 10 feet at least in diameter, and formed of coarse-grained red granite. Beyond the Itaipa a marshy slope leads to another undulating grass heath, with patches of wood here and there. We nighted at some ranchos off the path, where a fine orange plantation showed that a more considerable house had formerly been placed there. The arroyo Curucau, coming from a large estero or lagoon to right of the track, was the next to be passed, and then another series of undulating grass lands, from which a great plain could be seen opening out towards the Tebicuary, on the left.

Before going into Caapucu we visited a caña, or native rum, distillery, about a league from the Capilla. We found the work going on actively; round the house women were busily cutting down the canes from a large patch of ground: these were carried to the crushing mill, consisting of three upright cylinders of hard wood, set revolving against one another by long lever poles, to which oxen were attached. The canes were fed in between the cylinders by hand, and the juice falling into a trough below was conveyed at once to barrels sunk in the ground in a shed close at hand. Another rancho had casks of this juice, in all stages of fermentation, from which a simple retort is supplied. Twelve demijohns a day of the much-prized caña of Paraguay were made at this, probably the largest distillery in the country. The village of Caapucu appears with a high background of hills, for the whole of its department is eminently high and stony; entering it we were surprised to find it almost deserted, long rows of houses in the two squares standing empty and tenantless. The chief, however, told us that his department has 700 inhabitants, although little cultivation is possible from the stony nature of the soil. Between Caapucu and the pass of the Tebicuary the old estancios of Yaguari and of Cavañas are passed, both of which have fine pastures; the former estate embraces the little range of cerros of Yaguari, from the summit of which the first view of the winding Tebicuary is obtained. Cavañas estancia stretches down over the slope to the river. As illustrating the poverty brought on the country by the war, I may note that Capt. Page, in visiting this

estancia in 1855, says: "We stopped for dinner and siesta at the house of a rich Estanciero, Senor Cavañas, where we met with unusual luxury. Dinner was served on massive plate; water goblets and salvers were also of pure silver. All other appointments of this establishment, though simple, were exceedingly comfortable." The same Cavañas extended his hospitality to us, but his best and only plate is now a tin dish, in which a little "charque," or dried beef-strings, was served, with a few oranges, our host sitting on his bed the while, for lack of other furniture.

Approaching the pass of the Tebicuary we met a large drove of horses from Corrientes, being driven to Trinidad for sale. A number of deep ditches and waterholes on the north side of this pass render it exceedingly difficult in wet weather or when the river is high. Whilst we were passing two carretas simultaneously became fixed in one of these ditches, and one resisted the efforts of eight pairs of oxen to drag it out. The river at this pass has a width in its lowest stage of about 80 or 90 yards, and a depth of from 12 to 15 feet; almost all the little traffic from Southern to Central Paraguay must cross the river at this point: carts and passengers are ferried over in two little canoes, maintained by a government guard-house on the southern bank; oxen and horses pass by swimming.

A vast grassy plain, perfectly level, is crossed in the 10 miles which separate the pass from the little group of hills of San Miguel. The Tebicuary, curving round from the confluence of its chief tributaries, encloses this plain, which forms the northern corner of the Missions territory. Its grass, in contradistinction to that of any other part of Paraguay that I have seen, seems specially adapted for sheep, being of fine texture and short; in all other parts the grass is rank and high, only adapted for cattle grazing.

San Miguel is a little village in the department of Santa Maria, situated in the midst of a number of little wooded cerros; in one of these an iron mine was formerly worked. Its one square, surrounding a little church, has now about twelve inhabited houses.

From this our way outward led over a high undulating ridge which forms part of the division of the waters of the Tebicuary basin, and those which flow to the swamps of the Paraná. Dwarf "yatai" palms begin here to be dotted among the grass, the highest scarcely 3 feet above the ground; deer and ostriches appear now and again in herds, for these solitiudes are seldom disturbed by passengers. Santa Maria with its high cerro behind it, and San Ygnacio, also on rising ground, may both be seen from this ridge. Farther on some portions of the long straight ditches, cut over hill and dale under the Jesuit rule, to mark the limits of the different departments, may still be traced. Santa Rosa at the present time is an almost uninhabited square of decaying houses, but the church, which is one of the most elaborate of the old Jesuit structures, dating back to 1698, is in comparatively good order. Like all other large churches of the Missions, which have been built after one pattern, with differences only in detail, it is in form of a long cross (about 90 yards) with a very short nave, and with a college square adjoining one side of it, all with deep roofs supported by outer pillars, forming shaded corridors. A deep porch overhangs the chief entrance doors, which are large and massive. The interior roof of this, as well of the church, is elaborately painted in highly coloured frescoes. Carved wooden pillars, placed at intervals along the length of the church, support the roof, and these with the other beams look as fresh and new as if cut yesterday, testifying to the solidity of Paraguayan timber. The chief altar, as well as the confessional boxes and pulpit, are specimens of elaborate carving, representing fruits and flowers, and the six almost life-size figures of saints which fill the niches in the chief altar, are some of them exquisite in attitude and expression. Wrought-iron work of the most intricate sort is used in every instance for hinges or locks or ornamental gratings over the windows, showing that the smith's art must have been carried to perfection. The Paraguayans are now absolutely ignorant of any one of the arts so well displayed in the Mission churches, and the question naturally arises what has become of all this race of artificers, for they must have been natives, though taught by the Jesuits.

Little more than a league south of Santa Rosa is the entrance to the "Potrero,"* or enclosed pasture camp of San Antonio, the only land south of the Tebicuary which does not belong to the Government of Paraguay. This potrero is enclosed by the arroyos Picuiry (minnow river), coming from near San Ygnacio, and the San Antonio, from the hills of Santa Rosa, which meeting form the river or marsh drain of Yabebiry (ray-fish river) flowing to the Paraná. The northern side of the potrero, which is more than 50 square miles in area, is shut in by a mass of dense forest which lies south of Santa Rosa and San Ygnacio. Over the whole interior space there are scattered "islas" or clumps of fine woods, occupying perhaps a tenth of its surface, the remainder being covered with tall, rank grass. About 1000 cattle and horses, the largest, and one of the very few herds now in Paraguay, were kept till recently in this potrero; but having such an immense space of country to roam in, the cattle had become almost as wild as deer; the woods round it are also infested with jaguars, and in riding over it the horses would often start at a strong scent, or tremble and peer about in fear. In making our way to Encarnacion, after a stay in the potrero, we regained the track which passes Santa Rosa, where it skirts the base of the line of round wooded cerros, which extend south-east to opposite the little oratorio and ranchos of San Patricio. After crossing some of the branches of the great swamps of the Paraná, which run up into the country, the chief being the estero of Timbory (*Timbo*, the mimosa; *ry* or *y*, water), we reached the estancia of San Ramon, where there is one good house and large naranjal remaining, with several ranchos in its neighbourhood. Descending from San Ramon to a lowland, which, however, is still at some height above the Paraná, two long days' plodding through esteros and mud, and rounding the borders of dense patches of forest, were required to reach El Carmen.

Midway in this route the arroyo Curuniai, stagnant and ditch-like, but deep, was passed: the

* The name "Potrero" is given to spaces of pasture land which are enclosed naturally by wood or water, or both, on all sides; and they are valued highly as properties on this account, because cattle cannot easily stray from them.

Aguapé-y (*aguapé*, a lily-like water-plant with blue flower) is a more considerable river, with a strong current, and had to be crossed by swimming. An old estancia house near the Aguapé, belonging to the family of Barbosa, is still occupied by the lady of the former estanciero, who with his sons fell during the war; this is the most farm-like and comfortable habitation we saw in the Missions, where everything is ruinous and poverty-stricken in the last degree. Here—as in almost every rancho throughout the country—the women employ the leisure of the long evenings, seated on the ground about the wood fire, in spinning cotton thread by the aid of a little weighted spindle, the loose, cleaned cotton being wound round one arm and twisted by that hand while the spindle is rotated and dropped by the other. The larger houses have a rude hand-loom, in which cotton cloth of various textures is made for ordinary wear. Hammocks are home-made, also, a large frame being used over which the double longitudinal threads are stretched, the cross ones being worked in by hand in various patterns.

From a height a league west of El Carmen, a fine view opens out in the valley of the Paraná. On the Paraguayan side, the hills falling steeply down to the river, have a splendid alternation of dark forest and lighter pasture: grassy heights also slope gently from the Correntine side to the river, which appears at intervals in the landscape like a chain of lakes.

The river Tacuary (cane river), to which the track now descends, is fordable when low, but requires a canoe at other times. El Carmen, lies on a slight elevation in the midst of a low marshy plain, at a distance of a league from the Paraná. This must, however, have been a considerable place at the time of Page's visit to it in 1855, for he sets down its population at 1000. Now it well exemplifies the change that the war has brought over the once populous district of the Missions, for it has only two habitable houses, one the Guardia, the other kept by a woman who is custodian of the little church, eleven people making the total of its present population. The chief of this little place counted the inhabitants of his department on his fingers, numbering off fifteen houses or ranchos sheltering 55 persons in all, of whom 20 only are "barones." The few people gathered about here seem more than half Indian in cast of features. Last season only enough tobacco was grown in the department to keep the people in smoke, and the quantity of maize and mandioca was not sufficient for their wants.

After a short distance over the marshes of El Carmen, the Encarnacion track rises to cross the first of a long series of ridges and valleys, each with its arroyo, which terminate on the Paraná close by. These are the final spurs of the great dividing ridge or cordillera which comes down from the table land of Brazil. Indications of copper and perhaps also of some other minerals were seen in descending the water-worn track to some of the arroyos; indeed this whole series of ridges appears to present very interesting geological formations, giving perhaps an epitome of the whole cordillera. Two considerable rivers, the waters of which are sometimes backed up by the rising Paraná, the Ÿ-hú, or "black water," and the Mboi-caé ("roasted snake"), are passed by fords near their mouths. The smaller arroyos between these and El Carmen rise and fall very rapidly, but one only, the Caraguata-y sometimes interrupts the passage of the road, when a pass lower down named the Lavara, close to the Paraná, is used, provided that river is not flooded.

Encarnacion, founded in 1614, and once a leading reduction of the Missions, is now nearly deserted, only about a dozen of the many houses remaining in it being occupied. The place appears to have been well filled before the war, but most of its former inhabitants have now crossed the river to the new settlement of San José, or Ytapua. The old Jesuit temple of Encarnacion, taken down in the time of the elder Lopez, must have been a building of vast proportions, to judge by the exceedingly massive stone foundations which remain. The college squares beside it still contain almost the only inhabited houses. Its department, which extends east to the river Santa Maria, has a good number of "chacras," or small farms, growing tobacco, maize, beans, and mandioca.

A descent of about 150 feet from the village brings us to the river bank opposite to the Correntine village of Ytapua. Both the hill of Encarnacion and that on which Ytapua rises appear to be of old volcanic formation; the lava of which the foundations of the temple are chiefly built, appears on the Ytapua side. Some fragments of coal, which had been found in the neighbourhood, were shown me with great ceremony in a rancho on the Paraguayan bank, but they seemed to be pieces of burnt shale. The river here presents a magnificent expanse of water, 3000 yards across: the cattle ferry employs two small steamers which tow barges with corrals or pens placed on their decks, into which the cattle are driven down a gangway: about 20 canoes and small boats are also in use at the pass. A steep ascent of about 100 feet leads up through the settlement of Ytapua, or San José, a bustling, thriving place, apparently in rapid growth, and consisting now of a collection of rough sheds and ranchos, with perhaps 500 people in all—Argentines, Brazilians, and Italians.

Paraguay is now, and has been since the war, altogether dependent on outer countries for its beef supply, and almost the whole of this is derived from the Argentine province of Corrientes.

Cattle are brought across the river into Paraguay, by all the passes of Paraná, from the confluence of the Paraguay, up to the highest pass, that of Corpus, but this crossing of Ytapua is one of the chief, and by it an average of 40,000 head of cattle are annually ferried. From the Paraná, the herds are driven northward, chiefly to the centres of Asuncion (or Trinidad) and Villa Rica, but the whole of northern Paraguay, up to the town of Concepcion, is also dependent on Corrientes.

On the return journey, after passing again through El Carmen and over the Tacuary, we left the former track to turn south-west towards San Cosmé. Undulating slopes of tall grass, with patches of wood, occupy the country, till a descent is made to a wide "estero" reaching up from the Paraná, which must be crossed before the Aguapé-y is again reached. Here the Aguapé has become a deep, dark, slow-moving river. A dug-out canoe is stationed at the pass to San Cosmé, which lies on an ascent beyond. This reduction (founded in 1634) has the usual square, the church and college buildings;—all are in tolerably good

repair, but most of the dwellings stand empty, the whole population consisting of 3 men and 30 or 40 women. The church and colegio are remarkably fine; they are built with outer corridors, supported by squared columns of red sandstone, each 12 feet in height and about 16 inches square, with bevelled corners and massive capitals. Four columns which support the roofed gateway of the college buildings are much higher. The church contains much carved work and gilding, with many figures of saints, particularly of San Cosme, who is represented with salve box in hand. Many inscribed stones mark graves beneath the flooring; 20 great beams of lapacho, each from 25 to 30 feet in height, support the roof internally. During the war the whole of the people of this partido migrated to the district of Yuti, but a sort of re-exodus took place in 1869, when about 300 women marched back to their old district, each bringing a little grain or vegetable seed to recultivate the "chacras." The tobacco grown here is of a very superior quality, and is taken to market at Ytuzaingo or Ytapua, from a boat port about 1000 yards from the village. A land track through the marshes, formerly used between San Cosme and the pass of San José-mi, lower down the Paraná, is now impracticable.

Our way from San Cosme north-westward led along the borders of the vast marshes of the Paraná partly through the edge of the "estero," and partly over the wooded or grassy elevations which run down into it. The estero, viewed from this track, presents a dead level meeting the distant horizon, covered with tall grass or reeds, and with patches of open water here and there with aquatic plants, and is well-named Neembucu, the "endless." That part of it nearest San Cosme has the local name of Capii-pytá (red reeds). After three hours of plodding through the marsh, the Curuñai was again crossed. On a height beyond it, a track branches off at some ranchos called Ivira-ee-a-cuá (the place of the scent of the incense tree), to the district of San Luis. Another long stretch of marsh brought us to a height on which the estancia house of San Miguel is placed. Here an Argentine has settled, and keeps up a small farm with a few cattle, but his horses have all recently been destroyed by a disease known as "mal de cadera" which has done great mischief in Paraguay. Formerly a direct track led from San Miguel to Santiago, but this is now impassable on account of the depth of the marshes; the only way thither from this point is by a long detour through San Ramon. Even by following this roundabout way we could not altogether escape the swamps, and the deep estero of Piri-ty (the "reedy place") had to be crossed. This, though only half a mile in width, proved to be the worst of any we had yet encountered: it is covered with tall reeds, growing out of deep mud, in which the horses sank to the saddle, and it was only by wading up to the waist, and by dint of vigorous thrashing, that the animals could be got to flounder through it.

At Yacuti, a little cluster of ranchos two leagues from San Ramon, the track to Yuti branches off to the right, and not far beyond, a path leads to the estancia house of San Martin, where the main route southward to Santiago is struck. This main track lies over a high and uniform grass ridge as far as the capilla, which stands on a knoll of rather higher ground, descending at once on the farther side to the estero of the Paraná. The church and village of Santiago are the largest and most solid relic of the Jesuit work in the Missions. The interior elaboration of the church is perhaps even greater than at Santa Rosa: a few of the vestments, worked in gold and silver, remain; but the greater part of these, along with the whole of the silver furniture of the Mission churches, were seized by Lopez in the general conversion of everything of value in the country to war material; even the larger bells were melted down to be cast into cannon.

The "gefe" estimated the population of his department of Santiago at about 500, of whom about 100 are men; in the Capilla there are about 50 persons. This department must have been exceedingly populous in former times, since in the first enlistment made by Lopez for the war, 600 men between the ages of 15 and 25 years were furnished by Santiago.

From Santiago, unwilling to make another detour by Santa Rosa, we obtained a guide from the "gefe" to show us a pass on the arroyo San Antonio in a direct line to the potrero, but long unused. Riding a league or two west, over grassy heights separated by branch esteros from the Neembucu, we came to the San Antonio, and after some search among the high reeds on its banks, our guide pointed out the pass and left us. Gaining the opposite side with some difficulty, we found ourselves in an estero of tall reeds, which rose above us on horseback. Five hours were occupied in getting through this reed marsh, in which deep ditches from the arroyo seemed to meet us at every turn, and from the height of the vegetation it was almost impossible to know in what direction we were moving; only by standing on horseback could we occasionally obtain a glimpse of the woods beyond the estero.

A few days were occupied in examining the neighbourhood of the potrero San Antonio, and in laying in provisions, for this is the only place where we could get beef in the Missions; elsewhere mandioca and oranges are the staple food. The old reduction of San Ygnacio (built in 1610), which was our next halting point, differs in no way from the other Jesuit villages; and of the church it is difficult to say whether it displays more or less laborious carving and sculpture than the others. The place is now almost deserted, though there are houses enough in excellent repair for a large population; only about 20 people are resident. Santa Maria, which we next visited, is in almost precisely the same condition.

As far as Caapucu our return route was nearly the same as that taken in coming south; but from that place we struck northward for the village of Quiindi. In the valley between Cerro Leon and Cerro Medina we came upon two shafts, which were opened some years ago in search of mineral, but though pyrites is abundant, no other mineral has been found in quantity sufficient to repay working. Passing up the grassy or stony valley of the Apichapa, and crossing it not very far from its source, we ascended a steep high ridge on the opposite side, and from the summit obtained a magnificent view over the hills of Caapucu, which fill up the whole of the country west of us in a succession of groups of wood-covered hills and deep green valleys. Here and there, continuing our route along the grassy highland, we had views of the immense sheet of Laguna Ypoá (the "lucky water"), which appeared to touch the

western horizon. The only considerable rancho in this track is that of Lovera, where we found a welcome. The first district of Quiindi, called the Valle Apuá, has a number of ranchos situated prettily on a wooded ridge. The Y-pucu (long water), a brawling stream, and the Yacaré-y (alligator river), are crossed in a wide pastoral hollow before the little rising ground of Quiindi is reached. All along the route the knot of hills of Acaay stand out in sharp definition in the north, dark with the dense woods which cover them. The village of Quiindi, which has about 200 inhabitants, is in the form of two squares, one outside the other, enclosing a little barn-like church. The contrast between the flimsily-built houses of the lay reductions north of the Tebicuary, with the solid and regular structures in the Missions cannot fail to strike one.

A path leads hence through a most beautiful succession of woodland views to Tabapi, across the valleys of several little streams, flowing to the great Laguna. Here, for the first time, coming from the south, tall, graceful palms are seen among the forest trees. We found this little village, which is a sub-capilla of Carapegua, in fiesta over the making of miel or cane-syrup. It was the harvest of a small proprietor in the neighbourhood, and the whole of the inhabitants were assisting him to boil down the cane juice extracted in a little ox-driven crushing-mill. The boiling is kept up day and night, till the canes come to an end, and the occasion serves as a holiday for the whole neighbourhood. From a height a little outside the village, a fine view is obtained over the great lagoon of Ypoá, to the eastern margin of which the hills appear to descend. On the road hence to Carapegua the Tabapi arroyo from the Acaay hills is crossed, and to the left a great, low, plain opens out round the head of the lagoon; a wooded ridge is then climbed, and descending the opposite slope we come to Carapegua. This place showed more life than any village we had yet seen outside Paraguari: two or three stores seem to thrive, and its market-place looked busy; its population appears to be between 300 and 400, that of its department, which includes the district of Tabapi, being estimated at 1000. The department is also rich in the usual products, tobacco, maize, &c., upwards of 2000 arrobas of tobacco having been collected for sale in it during the past season. A slight descent from the village brings us again to the great uniform plain of Paraguari, in reaching which village from this point the two considerable fords of the Cañabe and the Mbaey are passed. In returning from Paraguari to Asuncion we took a direct road, which leads up over the centre of the plateau. Before reaching Jaguaron the path lies through a dense forest on the plateau, in the midst of which the unfortunate German colony of 1871 was planted. The conspicuous numbers along the path marking the lots of forest to be cleared are now almost the only signs of the colony remaining; but two or three indefatigable Teutons have, at a prodigious expenditure of labour, cleared little plots of ground in this wilderness, and live there in spite of all difficulties. A great drawback to the locality, besides that of the heavy timber, for which there is no present market, is the total absence of water, which is not to be got within a league of the colony. Jaguaron, prettily situated on the southern side of the plateau, with the sandstone hill of Dos Cruces rising above it, is an extensive village, with a huge church; but very few inhabitants remain, and to business of any sort it is absolutely dead.

Ytá, farther on, is a bustling place, with a busy market: it is here that the red earthenware "cantaros," or water-jars, which are used in every part of the country, are manufactured from clay found in the neighbourhood. San Lorenzo is also a flourishing, clean-looking village square, in which every house seems to be occupied. The straight track to the capital between these places is cut partly through fine woods, and on each side orange plantations, and ranchos with little cultivated plots, become more frequent; the road also becomes lively with passengers as Asuncion is approached through this most populous district of Paraguay, lines of white-dressed women going in single file, at a half trot, to or from market along the sandy track beneath the shade of the over-hanging trees, and always merrily "chaffiing" one another as they go.

On returning to Asuncion I learned that the Paraguayan and Brazilian Boundary Commission was about to start for a final journey to the northern frontier, and availing myself of the opportunity, I requested and obtained permission from the Government to accompany this Expedition and to draw supplies from the general commissariat for myself and an assistant. This Limits Commission, consisting of a section representing each country,* had been in operation already for two years. Its labours consisted in exploring and surveying the line of frontier decided upon after the war, in 1871, extending along the line of the Rio Apa to its source, and following the water-parting of the main cordillera and that of its branch, south of the basin of the Rio Ygatimi, to the Salto Guayrá on the Paraná. The most severe portion of this arduous task was in cutting a way through not less than 40 leagues of the dense forests which clothe the cordillera and the eastern slope of Northern Paraguay, and in finding and mapping the precise line of water-parting, a labour which required six months of constant work, and which was one of peculiar difficulty, since no food for the transport mules, other than the topmost leaves of the "Pindo"-palm, could be found for them in the forest, in consequence of which more than a hundred animals died of starvation. The line of frontier was subsequently marked at various prominent points by columns built by the Commission: one had been placed in mid stream at the mouth of the Apa, others at the source of the Ygatimi, at the pass of Espadim on the cordillera of Maracayu, and at a point midway between that and the Salto of the Paraná. Three central marks remained to be built—one at the confluence of the Apa and Estrella, another at the source of the Estrella on the cordillera, and a third between the sources of the Ypané and the Amambaya, in a space called the potrero de Julio.†

* The Brazilian under Colonel Galvao, the Paraguayan under Captain Ortiz; the cost and labour of the work have been incurred by Brazil, the Paraguayan section being only a formal accompaniment.

† The astronomical positions of each of these points were carefully determined in the first journeys of the Commission in a series of observations made by the Brazilian Major Araujo, who was formerly employed in the same service in laying down the Brazilian and Uruguayan frontier. The instrument employed in fixing the longitudes was a large transit which was set up in the meridian at each station. The survey of the fron-

This final journey was therefore planned to visit these points in succession, starting from and returning to Concepcion on the Paraguay. The Commission, consisting of 40 Brazilian and 10 Paraguayan soldiers, with their officers and a commissariat, with 16 ox carts and a troop of about 200 head of cattle, reached Concepcion on the 29th of July. This, the most northerly inhabited village of Paraguay, is formed of four or five streets, running back from the low bank of the Paraguay, crossed by others at right angles, forming house blocks of about 50 yards a side. Its largest buildings are two old "cuartels" or barracks, which face the grassy plaza, both very ruinous. Most of the habitations are merely mud ranchos, but there are a few substantial houses and at least three good stores. The number of occupied dwellings is about 150, and of the inhabitants about 600, of whom two-thirds are women. The working people of the place are for the most part Italians. At one time Concepcion was the depôt and seat of export for the northern "yerbales" of Paraguay, but this trade has all but ceased to exist, and only the morning and evening, drum and whistle, reveille of the guard stationed here, breaks the sleepy monotony of the place.

The country through which we passed from Concepcion north-eastward to the Rio Apa presents such uniform geographical characteristics, that a description of the track in detail seems superfluous. In general the land is undulating, being covered by low, gently swelling ridges, trending westward from the base of the central plateau; these are separated either by wide basin-like plains or the shallow depressions through which the streams and rivers flow westward towards the Paraguay. No part of it is mountainous or even hilly, and the "Sierra de la 15 puntas" laid down in M. Mouchez map seems to have no existence whatever; only in the far distance of the eastern horizon a few outliers of the plateau are to be seen. Narrow belts of wood cover the ridges and follow the streams, but between these, and occupying by far the greater part of the surface, are great grass camps frequently dotted over more or less thickly with straight-stemmed palms, generally the "caranday" or "coco." The woods of this section are as a rule disappointingly small, an exception being made of a belt of forest of heavy timber, which covers a ridge beyond the ranchos, marked Rincon on the map, near Concepcion.

The soil, being uniformly of a reddish or whitish sand, is dry and porous, and the grass, though it presents a luxuriant appearance, inclines to grow in tufts, each separated from the other by a few inches of bare sand; the camps are, however, traversable in any direction, swamps being quite unknown. For a few leagues beyond Concepcion ranchos with little plots of cultivated ground are frequently seen, and at Naranja-ty (the place of oranges), so named from the number of orange plantations about it, quite a small village is formed on each side of a little valley, but beyond this, nearer the Aquidaban the dwellings are fewer, and there they cease altogether. Between the Aquidaban and the Apa there is not now a single inhabited dwelling, though the posts of a few former estancia houses are seen at long intervals, as at Casal-cué, Ramocué,* and Sorat. The most noteworthy points on the route are the crossings of the Aquidaban and of the Apa; the pass of the former river used in this route is that known as Paso Mbotú (the name of a troublesome horse-fly which infests its vicinity): it is reached through the belt of wood which skirts the banks, and the river presents a fine appearance rushing down with brawling current between its steep banks of red sandstone, overhung with a dense vegetation, in which light palms and tall graceful canes interchange with the more bushy and darker forest trees or matted creepers. At the pass it is from 40 to 50 yards in width, and the depth in its normal state is about 3 feet, but after rain it rises with great rapidity. Another pass, named the Barreto, is used a few leagues lower down on a track which runs parallel with the one we followed, and which was the route taken by M. Du Graty in 1855. The Termentina, a considerable stream, stagnant and ditch-like at the pass, and about 15 yards wide and 3 feet deep, is the largest tributary of the Aquidaban, crossed on this line. The Apa is reached at the old military station of Bella Vista, the blackened house-posts of which stand nearly overgrown with vegetation: the river flows immediately beneath in a deep bed, with richly-wooded banks. At the pass the width between the steep sandy banks is about 25 feet, and the bed is strewn with large pebbles.

Unlike the Aquidaban its current is slow and regular. Scarcely a league above this pass is the confluence of the two head streams of the river: the one, still named the Apa by the Paraguayans, is a deep and slow-flowing stream coming from the north-east, its channel being the direct continuation of the lower river; the other, the Estrella, rushes in from south-east, with shallower waters, but a much more rapid current. On the first arrival of the Commissioners at this point, a geographical question arose as to which of these heads should be considered as the source stream of the Apa, and it was not decided in favour of the Estrella until after much debate and a careful survey of both tributaries. According to previous determination, one of the boundary marks was now built on the high promontory formed by the confluence, the red sandstone used being quarried from the bank of the Estrella beneath.† Some heights, scarcely to be called hills, rising northward of the Apa Valley, afford a wide view over camps and wooded ridges in the north and west. The track followed from the pass of the Apa towards its source, and the only one which has been opened in this direction, is the route from Paraguay to the Brazilian village of Miranda. It leads across the valleys of the northern tributary streams, at no great distance from the upper Apa. These arroyos are rapid streams, not large enough in themselves to form any obstacle to passage, but their valleys are deeply cut and narrow, their channels rocky and

tier had not yet been submitted to the Brazilian Government when I left Paraguay, so that I have not been able to make use of it in the sketch map.

* The terminal *cué* signifies abandoned, but in some instances it remains part of the name of a place, which though deserted at one time may have been re-occupied.

† The boundary columns are built on the uniform pattern of a square pillar 3 metres high, resting on a double basement of 2 metres square at the lower tier. The sides of the columns are placed to face the cardinal points accurately, and are inscribed "Imperio de Brazil" on two faces, "Republica del Paraguay" on the others.

broken, the ridges between being generally high and steep, partly wooded and partly grassy. From the summits of some of these separating heights, magnificent views are obtained across the valley of the Apa and Estrella, over which continuous forest, in every shade of green and brown, undulates away into the blue distance, where the dim outline of the Cordillera closes the view.

At the torrent called Arroyo de Oro by the Paraguayans,* which is one of the most difficult to cross, on account of the steepness with which its sides fall and rise, the Miranda track was left for a path made by the Commission of Limits, leading to the sources. A distinct edge of the plateau (shown in the section) is reached at a distance of about 7 leagues from the head of the Apa, where the track, cut through a forest of splendid trees, climbs up a steep, almost wall-like ascent of 600 feet. Reaching the plateau, the land is again undulating and grassy, and a swelling ridge in the distance is pointed out as the highest ground. Making towards this, we passed over a high grass plain, which, descending gradually to the woods on each side, divides the waters of the Apa from those of the Brazilian River Mondego. The highest grass ridge is at length reached: a hollow in its side allows a long belt of wood to run up from the great forest of the basin beneath, and at the head of this, a clear little rill, gathering from the grassy sides of the depression, is the source of the Apa. We had now reached the summit of the plateau of Amambaya, and the water-parting of tributaries of the Paraná and the Paraguay; it may be compared to a broad green avenue of one or two miles in width, covered with small flowering plants and tufts of grass, curving with a gentle descent to right and left, where, at intervals, little hollows occur, each filled with a clump of wood. Round these heads of wood on the upper side a crescent of rich green grass invariably appears, and in these marshy "manantials" the waters collect to form a source stream. This appearance of the water-parting is maintained almost without variation, as far south as the Potrero de Julio, beyond which the forest covers over the whole plateau.

At one place only the water-parting line was deviated from, to visit the little Brazilian colony on the bank of the Upper Dourado. It consists of a dozen mud ranchos, formed in two sides of a square, with a better log-house for the officer in charge of the 30 negro soldiers who compose this colony or out-post. No cultivation seems yet to have been attempted at this solitary spot, and supplies are drawn from Miranda.

The next boundary column was placed on the grassy water-parting between the chief head wood of the Estrella and that of one of the heads of the Dourado. A continuance of bad weather delayed us in this spot for three weeks; it seemed to be a battle ground for the hot north-east and cool south-west winds, and, from one side or other, fierce thunderstorms rolled up continually. The mark was no sooner built than a violent storm threw it down; it was built up again, and this had scarcely been done, when a furious gale, accompanied with vivid lightning and large hailstones, set in, levelling our tents and flooding the ground. This lasted during the whole night, and when morning broke, the column was again a heap. A small stinging fly is bred in myriads along the source marshes: its bite raises a little blood blister in the skin, which itches incessantly, and in fair weather from daybreak to sundown they are an intolerable pest. These flies gathered in clouds over the mules and horses, driving them often almost to madness, when they would break their tethers and gallop off to be rid of the plague. Between the source of Estrella and the Potrero de Julio, the only point of mark is an "isla" or large clump of wood in the midst of the grassy water-parting, called the Punta Poná (the beautiful spot), close to which there is a little lake. The portions of the water-parting immediately south of this, round which the head woods of the sources close in, are named the Potrero Capivari and Potrero de Julio, the latter name having been given by the Limits Commission. The mark placed here is at a point near one of the heads of the Ypané, where the hollows forming the heads of two streams of the opposing sheds are only a few yards apart.

At the southern border of the Potrero de Julio the woods close in, and the plateau becomes covered with forest over its whole surface. Here the picado or wood path, formerly cut by the Commission, begins and extends with little intermission to the Salto Guayrá. Under the guidance of the leaders of the Paraguayan section we went to see the "Picado," but on arriving at the edge of the forest it was found to be so completely changed in appearance during the twelve months that had elapsed since the path was used, that the entrance of it could not be recognized. After some search within the wood a part of the track was found: fallen trees and rapid undergrowth had already almost filled it up, but we were able to follow it for about a league. The first mile was through forest of splendid timber, by far the largest yet seen in the country, with massive, tall, and straight trunks: next we came to a "yerbal" mixed with smaller trees, but afterwards the large forest again resumes. The farthest point was the site of an old camp of the Commission, which had an interest since it was here that, in the first journey, a band of 40 bowmen of the Canguá Indians, sent by their chief, came to demand the reason why these paths were being cut through the solitudes of their domain.

The utterly desolate character of the whole region of Northern Paraguay through which we had passed is perhaps its most striking feature. A few wandering Indians are said to inhabit the forests in the extreme north, and occasionally we were told by the Paraguayans keeping watch by night over the cattle, that our camp had been reconnoitered by these timid nomads, whom they recognized by their calls, in imitation of birds; but I am inclined to set down these stories to the prevailing "bombero" superstitions of the country. Animal life is also extremely scanty. A few herds of small deer and droves of wild pigs were the only representatives of larger game that we saw, with the exception of one "anta" or tapir which was shot; and not even a foot print of the jaguar was observed. The "inuitou" or wild turkey is common enough in the woods, and these with the "tatu" or armadillo, and the large lizard called "tedju" afforded an occasional change of diet. Excepting the bell note of the "campaña" bird in the forest, and the melancholy

* The Brazilians have given this name to the arroyo next to this one, nearer the source of the Apa.

whistle of the "cogoeé" or wood partridge at sunset and dawn, the country is perfectly silent.

In returning, after the completion of the final boundary mark, the Commission retraced its route as far as the Punta Poná, from which a track turns westward, following the dividing ridge between the basins of Aquidaban and of the Ypané. The first return camp was at a point called the "Mangrullo," where there are still the tall posts of a look-out tower used in the time of Lopez's retreat to these wilds. Immediately beyond the Mangrullo the great yerbal of Chiriguelo is entered, and, for about a league, yerba trees are thickly scattered among the others of the forest; immediately afterwards, the track plunges down a steep forest slope exactly like that which we had ascended in reaching the source of the Apa, and of about the same height. On emerging from the dark thick woods at the base of this descent, we found ourselves in the midst of the hills of Cerro Corá.* The scene is wild and beautiful in the extreme; castellated crags and cones of the most fantastic shapes, densely wooded from base to summit, excepting where the red sandstone precipices appear, circle round a wide area through which the arroyo of Chiriguelo makes its way to the Aquidaban. The woods on the higher grounds were dark and dense, but below, the bases of the hills are marked out with curving lines and belts of light feathery palms bounding the grassy knolls of the central space.

Apart from its wild beauty, the spot has an intense interest as the scene of the last closing act of the long seven years' war which ruined Paraguay. It was here that Lopez when driven back into the deserts with the little remnant of his followers, made his last camp, where he was surprised by the Brazilian cavalry, and where he was killed whilst running down to escape to the hills by crossing the arroyo Chiriguelo. The site of the camp, about 10 minutes' ride from the Aquidaban, is still strewn with the undisturbed wreck of everything that belonged to it: carts, broken guns, and camp furniture of every sort, with numbers of skeletons lie scattered round. The sufferings of this last remnant of the Paraguayan army may be realised in following the track between this camp and the former one of Panadero, for under every shade-tree along it are the untouched bones of men who have lain down to die of wounds, weariness, or starvation.

KEITH JOHNSTON.

(To be continued.)

PARIS GEOGRAPHICAL CONGRESS.

ON the 1st of August, 1875, was opened, in the Salle des États, the ancient House of Estates in the Tuileries, the second "International Congress of Geography and kindred Sciences." The first Congress of this kind had been held in Antwerp, in 1871, almost immediately after the termination of the Franco-German War. The honour of having suggested this meeting belongs to M. Ruelens, and its successful issue to M. Hane Steenhuyse, supported by an active and influential local committee. Geographers from the principal countries of Europe met at Antwerp, a valuable collection of maps and other objects was brought together for exhibition, and a desire to convert this Congress into a permanent institution was general. Paris was chosen as the next place of meeting, and whether we look to the general accessibility of that city, to the geographical treasures which it contains, or to the universal attraction which it exercises upon all, no better choice could have been made. The Paris Geographical Society readily undertook the task of organising the next meeting, and Baron Reille accepted the arduous duties of General Manager or Commissaire Général. He was supported by 22 Commissaires, by a General Committee numbering no less than 162 members, and by an Honorary Committee of about 150 members. An "Executive Commission," presided over by Admiral de la Roncière le Noury, the President of the Paris Geographical Society, exercised general powers of control. The General Committee was subdivided into five sections (sections scientifique, d'organisation, d'exposition, de publicité, and de comptabilité). The scientific section again was divided into seven groups, for (1) mathematical geography, (2) hydrography, (3) physical geography, (4) historical geography, (5) economical geography and statistics, (6) didactic geography, and (7) travels. This complex arrangement had no doubt been considered carefully. Unfortunately it did not work very smoothly, and we have not attended any Congress where the arrangements, as far as the comfort of the members is concerned, were so unsatisfactory. There was no daily programme, no printed notice of papers to be read, and no list of members or their Paris addresses.

At the inaugural meeting, M. Hane Steenhuyse, the outgoing president, took the chair. He was supported by about a dozen members of the old committee. Having rendered an account of his stewardship since the Antwerp Congress, he resigned his office into the hands of Admiral de la Roncière le Noury, and presented him with a gold medal in commemoration of that day's proceedings. The Admiral then delivered an opening address, in which he dwelt upon the practical value of geography and its truly international character. He availed himself of this opportunity to assure the foreigners present that none could desire peace more ardently, nor stood in want of it so much, as France. The presidents of the foreign geographical societies then addressed the meeting in their native tongues, and thus imparted to it a truly international character. Baron Richthofen of Berlin, spoke first: he was followed by Sir Henry Rawlinson, M. Semenof (Russia), M. de Beaumont (Geneva), Signor Correnti (Rome), M. Hunfalvy (Pest), Dr. Schweinfurth (Cairo), and M. Veth (Amsterdam). Baron Reille then gave an account of the work performed by the Paris Committees of Organization. This inaugural meeting was honoured by the attendance of the Marshal-President of the Republic, and there were likewise present General de Baeyer, M. de Khanikof, Dr. Nachtigall, Dr. H. Kiepert, Colonel Montgomerie, Dr. Neumayer, M. Alfred Maury, Dr. Hamy, Dr. Rohlfs, M. Vivien de St. Martin, M. de Saulcy de Saussure, Major Wilson, and others.

In the afternoon a banquet took place in a marquee erected on the terrace of the Tuileries Gardens.

* The "corral" or enclosure.

It was presided over by M. de la Roncière le Noury, and toasts were drank to France and Marshal MacMahon, to the Foreign Governments collectively, to the foreign Geographical Societies, and to the Commissaire Général. Baron Reille returned thanks in the name of the latter, Sir Henry Rawlinson on behalf of the societies.

On Monday, the 2nd of August, the real work of the Congress began. The seven scientific sections met on that day for the first time, and the results of their discussions were communicated to the general body of members at six general meetings held in the Salle des États, and presided over by the presidents of the leading foreign geographical societies. At the first of these meetings M. Semenof, of the Russian Geographical Society, took the chair. He was succeeded by Sir Henry Rawlinson, Baron Richthofen of Berlin, F. Von Hochstetter of Vienna, supported by Dr. Hunfalvy of Pest; M. de Beaumont of Geneva, and Signor Correnti of Rome, supported by M. Veth of Amsterdam. Amongst the subjects discussed at the sectional meetings, those of the centesimal division of the quadrant and of a first meridian were perhaps the most interesting. The centesimal division was recommended by the first group, after Struve, D'Abbadie, Champcourtois, Colonel Stubbendorf, and others had taken part in the discussion; but it was rejected by the second and sixth groups, the naval officers, in particular, being strongly opposed to any change of the existing system. The Congress at Antwerp had already decided in favour of a first meridian passing through Greenwich, but at Paris this question was again brought forward and referred to an international commission. An international system of conventional signs, to be used on charts, was submitted by M. Ploix, and recommended for adoption.

The fifth group discussed M. Roudaire's proposition to convert a portion of the Algerian Sahara into an inland sea, Colonel Bogdanovich's projected railway to Tashkend and Peking, and various plans for constructing a Central American ship canal. The sixth group employed itself with educational questions, and recommended that professorships of geography should be created in connection with the superior schools, and that the basis of geographical instruction in elementary schools should be topographical and not cosmographical. In other words, that a knowledge of the home district, and of the phenomena to be observed there, should precede a more extended knowledge and a generalization of facts. The desirability of such a system of instruction has been recognized long ago in Germany, where Vogel, Delitsch, Finger, and others have advocated it successfully, and "Heimathkunde" forms a regular subject of instruction in most schools. The meetings of the seventh group were perhaps most numerously attended, for they afforded an opportunity of becoming personally acquainted with several of the most successful explorers of recent times. G. Rohlfs, Dr. Schweinfurth, Dr. Nachtigall, Dr. Meyer, M. de Compigne M. Soleillet, M. Veniukof, M. Severtsof, Dr. Leitner, M. Léon Rousset, and others, rendered an account of their travels and explorations, without, however, stating anything absolutely new.

On the 4th, the Paris Geographical Society held their ordinary evening meeting, in spite of the Congress, when many of the foreign visitors attended to listen to an interesting account of the observations of the Transit of Venus, by M. Janssen. But even this long array of meetings was insufficient to quench the thirst after geographical knowledge which brought so many geographers to Paris, in this one of the hottest Augusts on record, and almost daily there was afforded an opportunity of listening to one or two lectures on popular subjects. M. Rubinson explained his theory of aurora borealis; M. de Céssac rendered an account of his voyage to the Cape Verde Islands; Dr. Nachtigall lectured on his travels in Africa; M. de Barante spoke on the physical geography and the resources of Russian Turkistan; Captain Roudaire on the Shotts of Algeria; M. Léouzon Le Duc on the condition of women in Ancient Scandinavia; M. d'Hennequin on geographical instruction in the Paris elementary schools; Dr. Meyer on his travels in New Guinea; M. Antonio de Gogorza on a proposed Central American Canal; and Lieutenant Delaporte on ancient monuments in Cambodia. On the 5th several hundred members of the Congress visited the Gallo-Roman museum of St. Germain, when M. Bertrand, in spite of a most refreshing rain, explained the use of catapults and other instruments of ancient warfare. On the 8th a visit was paid to the museum of Khmer (Cambodia), at Compiègne, where the members were entertained most hospitably by the town authorities.

To the majority of foreign visitors the geographical exhibition, in connection with the Congress, proved a greater source of attraction than the numerous scientific meetings, and though far from complete, it afforded a vast amount of instruction to those interested in geography. The collection was arranged according to countries, a classification according to subjects, which would have rendered reference far easier, being confined to the catalogue. There was no limitation as to the period of production of the articles exhibited, and it thus happened that works of no particular excellence, and which had already figured at other exhibitions, again made their appearance at the Tuileries, and very unfairly competed with more recent works for prizes. We are of opinion that an exhibition of this kind, if it is to be instructive in reality, should be divided into three sections. The first of these should be representative in character, and should include only objects of superior excellence in each department of geographical science, or such as illustrate the state of geographical knowledge in particular countries. These articles should be classified and arranged without reference to the country of production, so as to render comparison easy. Cadastral plans, topographical maps, charts, statistical maps, surveying instruments, &c., would thus constitute each a separate class, and the relative merits of each country or establishment would be shown in a more prominent manner, than by an arrangement which collects the most heterogeneous objects in the same room, and disperses those which offer some analogy, throughout an extensive building. The second section would include all objects forwarded for exhibition, the only limitation being that they must have been produced or published since the last International Congress. A third section might be arranged to illustrate the progress of geography and particularly of cartography. We trust that these sug-

gestions will be remembered when the time arrives for arranging the third geographical exhibition, which is to be held five years hence in London.

It is quite impossible, within the space at our command, to do justice to a collection as vast as that exhibited in the rooms of the southern wing of the Tuilieries and on the terrace of the gardens. We shall therefore confine ourselves, on the present occasion, to a few general remarks.

Russia, which occupies the first place in the catalogue, likewise occupied one of the most prominent places in the exhibition, and nearly every geographical work published in that empire since the beginning of this century was to be found in the rooms allotted to it. In addition to published maps of all kinds—topographical, statistical, and ethnographical—there were numerous manuscript drawings, embodying the results of explorations not hitherto made public. The most important of these was a map of Northern Asia, on a scale of 1:4,200,000, which it is proposed to publish at an early date. Most of the articles exhibited have been produced at Government establishments, and they show that the Russian authorities pay every attention to the progress made in other countries and avail themselves of the best and most expeditious methods of producing their maps. The only private firm of importance represented was that of Colonel Ilyin, at St. Petersburg, which, though it cannot rival the productions of Perthes in Gotha, is nevertheless doing good service in spreading geographical tastes in Russia.

The sister kingdoms of Sweden and Norway exhibited the whole of their government publications, as well as a considerable number of private ones. The geological and statistical maps attracted a great amount of attention, as did also the plaster model of the huge meteorite found by Professor Nordenskiöld in Greenland. Denmark made a very creditable show. England was represented almost exclusively by public departments, for the British Government Commissioner had been appointed too late to enable private firms to prepare objects for exhibition. The maps, sketches, and other articles exhibited by the Trigonometrical and Topographical Survey of India, constituted the principal contents of one of the two rooms, and attracted the greatest amount of attention. The Ordnance Office exhibited several sheets of the survey of Scotland, which were deservedly admired. The Geological Survey had forwarded some huge portfolios, full of maps and diagrams. The Palestine Exploration Fund exhibited Major Wilson's model of Jerusalem. The Hydrographic Office of the Admiralty exhibited a selection of charts, the finest, by far, in the entire exhibition; and the Royal Geographical Society made a fine show with its publications, diagrams, and curious manuscript maps by celebrated travellers. There were likewise a few instruments by Captains George, Davis, and Bailey of the Royal Navy; but altogether the British department was far inferior to what it would have been had more time been available for preparation. The Netherlands were conspicuous by their meteorological apparatus, and amongst the maps, those of Java, which are beautifully printed in colours, attracted most attention. Germany made a fine show in spite of the policy of abstention pursued by the leading Government departments. The maps engraved at Perthes's Geographical Institute at Gotha, were amongst the very best exhibited, particularly so those of France, Spain, and the United States, which form part of the last edition of Stieler's Hand Atlas. Kiepert's wall maps for schools are deserving of attention, and altogether German publishers deserve credit for an intelligent spirit of enterprise which is not always met with in other countries.

The geological map of Saxony and Thuringia, published by the Berlin Geological Institute, on a scale of 1:25,000, should be noticed as the first map of that kind on so large a scale. Austria was most amply represented by the Military Geographical Institute at Vienna, but other government departments, as well as numerous private establishments, made likewise a most creditable show. We were particularly struck by a series of agricultural maps exhibited by the Cadastral Office of Vienna. The finest object in the Belgian department was Professor van Rysselberghe's "Meteorograph" or "Universal Registrar." The Italian room contained but little that was remarkable, though considerable progress has been made within the last few years, and the efforts made by Signor Cora, the editor of the *Cosmos*, and others, to spread geographical knowledge, are evidently beginning to bear fruit. Switzerland may fairly boast of having made some of the most valuable cartographic contributions to this exhibition. The fine map prepared under the supervision of General Dufour still stands unrivalled for beauty of delineation, and numerous private firms vie with the Government engravers in the beauty of the work they turn out. Spain had little to show, as yet, except the useful set of maps prepared by Senhor Coello, but a Topographical Survey is in progress, and the two first sheets of a map on a scale of 1:50,000 were exhibited. Portugal, though excluded from the catalogue, exhibited her Topographical Atlas as well as a geological map. Turkey exhibited several manuscript maps, including one of Yemen, and a lithographed map of Montenegro, copied from the Russian survey.

The only European country not yet noticed is France. To those who readily accepted the assertion that geography was a science not cultivated in that country, the very formidable show made must have proved a matter of surprise. The maps published by the Dépôt de la Guerre, and by other public departments, may fairly rank with similar works published in other countries, and the example thus set is not lost upon private publishers, amongst whom Messrs. Hachette occupy a prominent position for a spirit of liberal enterprise. A general atlas, now preparing for publication by that firm, from designs furnished by M. Vivien de St. Martin, promises to become one of the most precise works of that class. Amongst relief maps, that of France, by Madlle. Kleinhans, deserves to be mentioned, for it is one of the very finest in the exhibition. There are certainly in the French department many objects which ought not to have been exhibited, but taken as a whole, the French have no cause to be ashamed of the part they took in this exhibition.

Extra European countries were represented only in a few instances, and the United States, which might have made a very fair show, were confined to a small room, where their ill-arranged collection attracted but little attention.

A separate room was allotted to the Alpine Clubs, and some of the most valuable cartographic treasures of the Bibliothèque Nationale were exhibited in the Galerie Mazarine.

Some idea of the share taken by each country in the exhibition may be formed from the number of articles enumerated in the catalogue, which is as follows :—

France, 1579; Austro-Hungary, 581; Russia, 483; Netherlands, 335; Germany, 250; Switzerland, 231; Sweden, 229; Argentine Confederation, 159; England, 139; Belgium, 125; Denmark, 110; Norway, 100; Italy, 92; Spain, 62; Turkey, 48; United States, 29; Chili, 26; Japan, 13; Hawai, 8.

Seven international juries were charged with the distribution of the prizes. These juries were presided over by General Ricci, Admiral Acton (Italy), M. Semenof, Dr. H. Kiepert, Dr. Hunfalvy, Dr. von Becker, and M. de Khanikof. Each jury consisted 19 members (4 French, 1 German, 1 English, 1 Austrian, 1 Belgian, 1 Danish, 1 Spanish, 1 Dutch, 1 Italian, 1 Norwegian, 1 Russian, 1 Swedish, 1 Swiss, 1 Turkish, 1 Argentine, and 1 American); and there were in addition 1 Reporter, 1 Secretary, and 1 Commissioner. Several of the members served on more than one jury (England, for instance, had only two representatives, Colonel Montgomerie and Major Wilson), and as the meetings generally took place simultaneously their votes were thus lost, on critical occasions, to their clients. We feel sure that the decisions arrived at by these juries will not, in many cases, meet with the approval of geographers, and although the number of prizes awarded is exceedingly large, several exhibitors of merit have been passed over in favour of others to whom no distinction was due. This is felt even more by French exhibitors, with whom we have conversed on the subject, than by foreigners. We have likewise heard objections as regards the large number of prizes awarded to publishers and government departments in preference to conferring distinction upon the authors of the works exhibited. We propose, in our next number, to give an analysis of the whole of the prizes awarded. For the present we confine ourselves to mentioning the English prize-takers, as well as those government departments, firms, and private persons, who received letters of distinction. Of the latter no less than eighty were awarded, viz., to—

Topographical and Geodetical Departments (Depôts de la Guerre, &c.):—France, Russia, Sweden, Norway (2), Denmark, England, India, Netherlands, Java, Austria, Belgium, Italy, Switzerland (2), Spain, Turkey (!), Portugal.

Hydrographic Offices:—France, Russia, England, Netherlands, Spain, United States.

Geological Survey Offices:—France, Sweden, Norway, Prussia, England, Austria, Switzerland.

Meteorological Departments:—Russia (Physical Observatory), England, United States (Signal Service).

Statistical Departments:—Austria, Hungary.

Public Libraries:—St. Petersburg, Brussels.

Observatories:—Pulkova.

Other Government Departments:—France (Dépôt of Fortifications and Ministry of Public Education), Educational Museum of St. Petersburg, Colonial College at the Hague, Hawai (!).

Geographical Societies:—Russia (2), London, Rome.

Academies:—Venice, Madrid.

Alpine Clubs:—French, Austro-German, Swiss, Italian, London, Carpathian, Tatra, Styrian, &c.

Palestine Exploration Fund.

Public Companies:—Suez Canal Company, St. Gotthard Tunnel Company, Great Northern Telegraph Company.

Publishers:—Kühne, of St. Petersburg; Messrs. Hachette, of Paris; M. J. Perthes, of Gotha; M. D. Reimer, of Berlin.

Private Individuals:—M. de Quatrefages (for works on anthropology), General Kaufmann (exploration of Turkistan), Admiral Lütke (voyage of the 'Seniavin,' 1826-29), Professor Nordenskiöld, Messrs. Torrel and Von Otter, jointly (Arctic explorations), Archduke Louis Salvator of Austria (work on the Balearic Isles), Professor Von Rysselberghe (meteorograph), M. Mülhaupt of Bern (engraver).

France received 12 letters of distinction; Russia, 11; Austria, 10; England, 8; Switzerland, 6; Italy, 5; Germany, Sweden, and the Netherlands, 4 each.

In addition to the above, the following British exhibitors received medals or were honourably mentioned, viz. :—

1st Class Medals:—Members of 'Challenger' Expedition, Geological Survey of India, Staff-Commander George (double sextant and barometer).

2nd Class Medals:—General Sir Henry James, the late A. Findlay, Mr. J. Thomson (Chinese photographs).

Honorably Mentioned:—Mr. Henry Hennessey (author of geodetical tables), Captain Evans, Captain Richard Mayne, Captain J. E. Davis (sextant), Colonel Gordon, Captain Chapman (of Forsyth's Expedition), Major Herbert Wood (Oxus Expedition), and Lieutenant Collingwood.

The executive commission awarded additional letters of distinction to the museum of Khmer, at Compiègne, and to MM. Payer and Weyprecht.

The final meeting of the Congress took place on the 11th of August, under the presidency of M. Wallon, the Minister of Public Education, and was honoured by the presence of Marshal MacMahon, of the Grand Duke Constantine of Russia, and of many other persons of distinction. M. Wallon delivered an address on the results of the Congress; M. Maunoir, the Secretary of the Paris Geographical Society, made a statement of the work performed by the Executive Commission, and the venerable Commandatore Negri returned thanks on behalf of the foreign associates, for the hospitable manner in which they had been received. The presidents of the various sections then announced the names of the exhibitors to whom prizes have been awarded, and the proceedings terminated.

Our account of this Congress would not be complete without a reference to the receptions held at the mansions of Marshal MacMahon, M. Wallon, and the Prefect of the Seine, invitations to which were extended to all the members of the Congress without distinction.

E. G. RAVENSTEIN.

THE VOYAGE OF THE 'CHALLENGER.'

VII.

IN a former number (October 1874) the section of the exploring voyage of H.M.S. 'Challenger,' comprised between the Cape of Good Hope, towards the Antarctic regions and Australia, was completed, and in the number for February 1875, some additional notes on that section were added.

On the 17th of March the 'Challenger' anchored in Melbourne, and remained there a fortnight. Leaving on the 1st of April, she passed through Bass Strait, close to the northward of Rodondo and Moncœur Islands, reaching Sydney, New South Wales, on the 6th, to refit. The ship was docked, refitted, and completed with coal and provisions previous to continuing her voyage. The officers and crew fully enjoyed their sojourn in that magnificent harbour,

and the hospitality they received was unbounded, but science was not neglected during their two months' stay in Port Jackson. During that time, Professor Wyville Thomson made a journey to Queensland for the purpose of studying the natural history of tropical Australia.

The next part of the proceedings of the 'Challenger' was one of great interest, both to the colony of New South Wales and New Zealand, for a line of soundings was to be taken between the two countries to ascertain the fitness of the ocean bed for connecting them by means of a telegraphic cable. The 'Challenger' sailed on the 8th of June, but was met by a gale sufficiently strong to prevent any work being undertaken and she was obliged to return to port, from which a second and final start was made on the 12th. Still the weather was unfavourable for sounding, and still more unfavourable for dredging. The few hauls that were taken on the passage across proved that animal life was scarcer than is usually found at the sea bottom, but some good specimens were obtained, an entirely new species of sea-egg being noticeable. From the Australian coast the water gradually deepened to 950 fathoms, it then more suddenly deepened to 2100 fathoms at a distance of 55 miles from the land, but the weather was so stormy that the line parted in heaving in. No soundings were obtained on the 15th, on account of a fresh gale springing up from the S.S.W. During the night the spurs of the cutter's davits were struck by a sea, and the cutter thrown up into the mizen rigging.

On the morning of the 16th, after steaming in towards the land, a sounding was obtained in 2500 fathoms; but the line again parted, this time in consequence of a flaw in it. Serial temperatures were obtained to 1500 fathoms. Proceeding on her course against a head wind and sea, soundings were taken on the 17th in 2600 fathoms at a distance of 240 miles from the Australian shore; the temperature at the bottom being 33°. On the 19th, at a distance of 140 miles from the last sounding, the same depth with the same bottom temperature was obtained. Serial temperatures were taken to 1500 fathoms, and specimens of water obtained to a depth of 400 fathoms. In these two last soundings the bottom consisted of the red clay of the deeper waters, whilst on either side the usual globegerina ooze was found. This deep trough between the two lands is about one-fourth the distance from the Australian shore.

Early in the morning of the 21st, a sounding was made in 1975 fathoms, and serial temperatures obtained. The wind freshened to a gale at night, and the fore-topmast staysail stay carried away, the sail being with difficulty saved. At 1 o'clock on the 22nd, soundings were obtained in 1100 fathoms, with a bottom temperature of 35°·7; serial temperatures were taken, and early the next morning a sudden shoaling of water was found, the depth being 275 fathoms, with hard bottom. Two more soundings the same day gave 350 and 400 fathoms, the bottom of the last sounding being clay. Early the following morning 400 fathoms were found, and three hours after 150 fathoms. Just before noon Mount Egmont was seen.

On the morning of the 25th a course was steered for D'Urville Island, and at 5 p.m. the 'Challenger' anchored in Port Hardy. The next day a strong south-east gale, accompanied by a heavy sea, rendered it advisable to remain in port; but on the morning of the 27th, still blowing hard, the ship steamed out, making but little way against the heavy sea. As there was no chance of reaching Port Nicholson before night, anchor was cast in Queen Charlotte Sound, near Long Island. Next morning the 'Challenger' again put to sea, but the wind being against the current, it caused a nasty sea. Soon after noon a sad accident occurred which created a feeling of gloom throughout the ship. A seaman gunner had just taken his place in the chains as leadsman, when the line fouled the anchor-stock, and in attempting to clear it a heavy sea struck the vessel on the lee bow, which threw her over to windward. When she righted the poor leadsman was missed. He was supposed to have sunk immediately, as he was not again seen, although the ship was immediately hove-to and men from all parts of her on the look-out for him. The man, Edward Winton, was greatly respected, and his loss was, therefore, much felt by all.

At 4 P.M. the Heads were passed, and at 5 P.M. the 'Challenger' anchored in Port Nicholson.

After a stay of a week at Wellington, during which period the weather was anything but what could be wished, reminding the voyagers more of Kerguelen Land than was at all desirable, the 'Challenger' weighed anchor on the 6th July and under steam proceeded out of the port; but as the weather became thick, with a strong north-west wind and squalls, it was impossible to proceed; the ship was therefore brought up in Worser Bay for the night, and at 6 the next morning she succeeded in clearing the Heads and stood to the northward under sail.

On the morning of the 8th steam was got up and a sounding obtained in 1100 fathoms, with soft green mud bottom, in lat. 40° 13′ S., long. 177° 43′ E., temperature 35°·6. The same afternoon the trawl was put over and a number of specimens of holothuriæ, shrimps, worms, &c., secured. Continuing along the east coast to the northward, at daylight on the 9th, the Mahia Peninsula was sighted, and on the 10th they sounded in 700 fathoms and obtained serial temperatures. Leaving the New Zealand coast they proceeded north towards the Kermadec Islands, but the nature of the weather prevented sounding operations. At 10 P.M. on the 12th Macaulay Island, of that group, was seen; the course was then altered for a position between Macaulay and Raoul Islands, and at 7 on the following morning a depth of 520 fathoms was found. The trawl was put over and different species of sponges, star-fishes, &c., obtained, and the general resemblance between the animal forms brought up from about the same depths off the coasts of Portugal and Africa was noticed. The following morning, the 14th, another haul was had in 600 fathoms, north of Raoul Island, which proved equally prolific, and as three or four specimens new to science were discovered, the naturalists were satisfied. The bottom was composed of lava pebbles and pumice, and although more than usually dangerous to the trawl, they succeeded in working it without accident. Raoul, or Sunday Island, was discovered in 1793 by Admiral D'Entrecastreaux: it is triangular in form, about five miles long east and west, and four miles broad. It is high and rugged, three of the peaks rising to about 1600 feet above the sea, the precipi-

tous sides being covered with wood. Captain Denham visited this island in 1854, at which time only one family lived on it.

Macaulay Island is a small, round island, about three miles in circumference; it is very steep, and rises to a height of 750 feet.

On the 17th, in lat. 25° 5′ S., long. 172° 56′ E., a depth of 2900 fathoms was found (the deepest since leaving the Atlantic), with a red clay bottom, the temperature at that depth being 32°·9, this temperature proving that there is a continuous deep channel from the Antarctic seas.

On the morning of the 19th, they hove-to off the island of Eooa to await daylight, and at 7 o'clock Tongatábu was seen right ahead, Euaigie Island being on the starboard bow, and in the evening the 'Challenger' anchored off the king's residence at Nukalofa.

Tongatábu group is the principal and most southern of the Tonga or Friendly Islands, and derives its name from the largest island. The island of Eooa lies to the south-east, 9 miles from Tongatábu, and although the smaller island rises to a height of 600 feet, the larger, Tongatábu, is flat, the highest point, on which the church now stands, being only 60 feet high; a few other hillocks of 30 or 40 feet may be seen.

Tongatábu Island is 23 miles long east and west, and about 8 broad, and in the form of a crescent, bearing its convex side to the south, while coral reefs extend 6 to 8 miles off the concave side, and form numerous channels leading towards the harbour. There are but two of these channels navigable for ships, one to the east, the other to the north, through which vessels thread their way by observing from the mast-head, the discolouration of the water caused by the coral reefs. A lagoon about 3 miles deep, into which there is only a passage for a canoe, lies 4 miles east of the town of Nukalofa. It leads up to the town of Bea, which may be termed the stronghold of heathenism on the island, the natives retaining much of their original characteristics.

The soil of the island is rich and very fertile; the luxuriance of the foliage can scarcely be surpassed. In some parts of the island the soil consists of a blackish mould, which emits an agreeable odour of bergamot, but it quickly evaporates in the air.* The population is estimated at 5000, of which about one-fifth are Christians; supplies of food may be obtained, but the great want is fresh water, there being no streams on the island, water being only procurable by digging, and such as is obtained by that means is not good.

The Friendly Islands form an independent state, and now have a national flag. The king (George) was residing at Nukalofa. He is a hale old man of about seventy-five, with a pleasing expression of countenance, the face being fringed round with white whiskers and beard. The queen was not so prepossessing: she is very stout, and seemed conscious of her dignity in her European dress, her head being surrounded by gipsy hat and feather, after the most violent type of servant-gal-ism. Young as the country is, the people understand direct taxation, a poll-tax of seven dollars being levied on each adult, whilst a most effectual bar to drunkenness is effected by the excise, in a licence duty of 100*l.*, levied on spirituous liquors of any kind, and a customs duty of two dollars per gallon on spirits, one dollar on wine and a shilling on each bottle of beer. There are consequently no public-houses; moreover every sailor is required by the law to be on board his ship by eight o'clock in the evening.

No sooner had the 'Challenger' anchored than she was surrounded with canoes, containing a great number of natives, who soon found their way on board; and a fine race of men they were—tall, robust, with intellectual features, and singularly good looking; the women being decidedly handsome and very fair, might easily be mistaken for half-castes; but notwithstanding their superiority in form and intellect to the races found on other islands, they are equally indolent, for very little labour being required to produce almost any crop, they are too lazy to cultivate as the islands abound with cocoa-nuts, bananas, oranges, yams, &c. which grow almost spontaneously.

The usual dress of the natives is much the same for the males as for the females, viz., a roll of "tapa" wrapped round the loins; but the influence of the missionaries has caused this revolution in dress, that they must appear more decent in company, and a fine of a dollar is imposed on a man that ventures to put his foot on board a ship without having a regular shirt on. The women are not permitted to visit ships at all. Some of the natives have adopted the European dress, and wear it with much pride; the women, as is natural, are fond of gay-coloured dresses, &c. The manufacture of the tapa from the bark of a tree is discouraged as much as possible in order to induce the natives to cultivate the cotton-plant, which thrives wonderfully on the luxuriant soil of the island.

About forty white people are resident at Nukalofa, and as is unfortunately the case in too many places, the missionary labours are divided by two very different sects, the Wesleyan and the Roman Catholic.

The village or town of Nukalofa is prettily situated in a bread-fruit and cocoa-nut grove. The church is the most conspicuous building on the island, as it is situated upon its highest hill. It is a neat-looking building, divided into three aisles by two rows of columns that support the frame-work of the roof, which is thatched with the leaves of the sugar-cane. Near the church door is a monument erected to the memory of Commander W. Croker, who was killed in an unsuccessful attack on the village of Bea in 1840. The church is capable of holding from 700 to 800, and on the Sunday was well attended. A native preached, and the singing, accompanied by a tolerably good organ, was sweet and in excellent time. So far back as 1797, the London Missionary Society sent missionaries to this island, but the warlike nature of the inhabitants caused them to quit the field, and a quarter of a century later, the Wesleyans commenced their labours, and their efforts have been eminently successful; most of the natives having embraced Christianity, and schools have been established.

On the morning of the 22nd of July the Expedition left Tongatábu and after taking a few hauls of the dredge in shallow water, proceeded towards Fiji. On the 24th they stopped off Mataku Island to land a party of surveyors and naturalists, and during the time they were on the island the ship trawled in 300 fathoms water. Among other treasures obtained was a fine specimen of the pearly nautilus, *Nautilus pompilius*,

* Findlay.

which was kept alive in a tub for some time in order to observe its movements.

Mataku is the southernmost and perhaps the most beautiful of the Fiji Islands. It was discovered by the French navigator D'Urville. Its face is broken into volcanic peaks, the highest reaching 1260 feet above the sea level; it is 4½ miles long and from 1 to 3½ broad, and fringed by a coral reef nearly a wash, through which, on the western side, is a channel, with 30 fathoms water, leading into a fine basin.

Pigs and poultry, with wood, water, and vegetables, can be procured. The naturalists were very successful in their researches through the island, as many birds of brilliant plumage were shot, and a rich harvest of botanical specimens secured.

The following day the 'Challenger' arrived at Kandavu Island, anchoring in Ngaloa Bay, and as this had been selected as the port of call for the mail steamers between Australia, New Zealand, and San Francisco, a few days were spent in surveying the anchorage. The idea of this route, however, has since been abandoned.

Kandavu is the south-westernmost of the Fiji Archipelago, and was discovered by D'Urville in 1827: it is 25 miles long, and is high, excepting a small part at its centre. At the west end is the conical peak of Kandavu, about 2000 feet high: it is very much truncated at the summit, the sides descending in in a straight inclination to the sea. The island is beautiful and well covered with pine timber, much resembling the New Zealand kauri pine, from which most of the large canoes used by the Fijians are built. The island is much used as a port of call to the whalers of the South Seas, as abundance of provisions are to be obtained.

After a stay of two days at Ngaloa, the 'Challenger' proceeded to Levuka, Ovalau Island, and found here a barque laden with coal awaiting her arrival. Previous to this, intelligence had reached the place that a large French man-of-war steamer was on shore on the reefs of Wallis Island, and H.M.S. 'Dido' immediately left to her assistance, but on reaching the island found the ship a total wreck. Assistance was offered and declined, as part of the crew had been sent in a German vessel to New Caledonia, and it was expected that one of their own ships would come to their relief.

Ovalau is a high, small, and almost circular island, being 8 miles long by 7 broad; the loftiest peak is nearly 2090 feet high. It is of volcanic formation. The valleys extend but a short distance inland, but they are well cultivated: Levuka harbour is on the east side and is well protected by reefs and easy of access. The town is situated in a valley and surrounded by a dense grove of bread-fruit and cocoa-nut trees, and has a fine stream of water running through it to the beach.

The 'Challenger' left Levuka on the 3rd of August, returning to Ngaloa, where she remained until the 10th.

Previous to leaving the Fiji group, a party of labouring men, natives, who had completed their engagements in Australia, were embarked for a passage to their home in Api, one of the New Hebrides group, and reported to be one of the most savage of that savage group. The men were quiet and inoffensive, and greatly enjoyed their improved diet on board the ship. While on board they exhibited their treasures, the result of four years' labour, which were considered to be worth less than 5*l.* at Australian prices, the hatchets and knives having been "made for sale!" Notwithstanding the apparent hardships of their servitude they were well content, and their influence on their countrymen, after working for and with the white men, must be considerable. On reaching Api, they appeared much alarmed lest they could not be landed on their own particular part of the coast, but it was not without some difficulty that they were landed at all.

About midway between the Fiji Islands and New Hebrides, the depth was 1450 fathoms, with a red clay bottom. When about 30 miles from Kandavu a sounding was obtained in 1350 fathoms, and in trawling, the trawl fouled something at the bottom which gave much trouble in clearing, but nothing of interest was obtained. The tangles brought up a branch of wood two feet long.

On the 17th the Expedition passed through the New Hebrides group between the islands of Makura and Two-hills, finding a clear passage between them, and, without anchoring, proceeded on her way towards Torres Strait. On the 19th they sounded in 2650 fathoms, red clay. The serial temperature soundings at this and the other sounding stations as far as Raine Island, show that the temperature at the bottom, instead of being 33° is 35°, which is the same as at 1300 fathoms, and proves that below that depth this sea is cut off by a surrounding ridge, over which the greatest depth of water of any channel through it is 1300 fathoms. As this depth is about that found between New Hebrides and Fiji Islands, it may be taken for granted that from Sandy Cape in Australia to New Caledonia, New Hebrides, Solomon Islands, and New Guinea there is a bank with not more than that depth of water. Below this depth, in the hollow between New Hebrides and Torres Strait, the water is comparatively stagnant, as in the Mediterranean and other cut-off seas.*

Between the 19th and 27th August, in a run of 1000 miles, four soundings were taken at depths exceeding 2200 fathoms, the temperature of the bottom remaining the same. On the 28th, when 170 miles from Raine Island, the depth was 1700 fathoms, and at a distance of 74 miles from it 1400 fathoms, showing that the inclination of the bottom of the sea is gradual towards the Barrier Reef.

The 'Challenger' entered the Great Barrier Reef of East Australia through the Raine Island Passage on the 30th, and anchored for the night near Raine Island. On the following morning a visit was paid to the island, which is of coral formation, about one-third of a mile long and a quarter of a mile broad, and only about 20 feet above the level of low water. The passage was much used in former times, and as many vessels were wrecked upon the numerous coral reefs, Captain F. P. Blackwood, in 1844, built a circular tower or beacon 64 feet high, of stone hewn on the island. It consisted of a series of chambers one above the other, and was furnished with a store of provisions and a tank of water. It was painted in red and black vertical stripes, and from a ship's masthead

* These and other facts connected with the soundings and temperatures are derived from the "Reports of Her Majesty's Ship 'Challenger.'"

could, in clear weather, be seen from a distance of 12 or 13 miles.

The stone-work of the beacon was found by Captain Nares in good order; the woodwork, however, had long since decayed, but in falling had not injured the masonry; indeed the building did great credit to the sailor architects. No supplies were found, and the iron water tank had nearly rusted away. The sea birds were in clouds, and so dense a mass did they form when hovering overhead that the darkness created by them was apparent. The nests covered the ground so thickly that it was difficult to walk without treading on them. New-laid eggs were found in the nests of some of the tern, and young birds in all stages of growth in others; and, as was said of the penguins of Nightingale Island, of the Tristan da Cunha group, had the birds of Raine Island been aware of the advantage of combination, they could well have withstood the landing of the strangers.

The Expedition arrived at Somerset, Cape York, on the evening of the 1st September.

J. E. DAVIS.

Reviews.

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THE ABODE OF SNOW.*

THE advantage of having before us, comprised within the compass of an octavo volume, such interesting and really valuable notes as these, will be sufficient excuse for reviewing at somewhat greater length than is our wont, a work, a great part of which has already appeared in a monthly magazine. Mr. Andrew Wilson happily ranks above the general run of English travellers in regard to his freedom from prejudice, and at a time when the national interest in Indian affairs is perceptibly and surely increasing, it is a matter of some significance to find that the deliberate opinions of an intelligent outsider, though tempered now and then with no sparing criticism, do in the main support the general policy of our Government in India. Some of his early observations form the greatest imaginable contrast to the spurious and grotesque philanthropy which a long estrangement from, or a total ignorance of, India appears so inevitably to breed in our home press writers. Speaking of the employment of natives in offices of responsibility, of which we have heard and still hear much, he remarks that the result has been to push forward a class of natives who exercise no influence over the people, are entirely mistrusted by them, and who cannot but regard us with hatred. But this observation is one made *en passant*, the theme being a question of still greater moment, and one of which of late years has become a matter of real urgency—we mean the question of the poor whites and Eurasians. Of these, he says, "They form a large and ever-increasing class of poor whites and half-castes who are a scandal to the Christian name and the white race, having been forced by circumstances to depths of misery and depravity unknown among the jungle tribes; and hence the painful fact that the large towns of India contain a number of respectable, fairly educated English and Eurasian people who are at their wits' end how to live."

This picture should wake an active anxiety in the breasts of rulers, and though perhaps few may care to endorse the extreme opinion quoted by the author, that the next rebellion in India would be on the part of the Europeans and Eurasians, and that every soldier who had been six months in the country would be on their side, it should nevertheless be recognized that the growth of this class will become powerful for evil as well as good, but that careful legislation might discover herein the germ of a future population, which, by its familiarity with the people and climate, not to speak of stronger ties in the case of the half-castes, would forge an adamantine link between the colony and its mother country.

A pleasant chapter is that devoted to Simla and its society—the Capua of India as some term it. This appellation, however, the author does not see the justice of. He points out with truth that Simla having no open law courts to speak of, no shipping, mercantile, or other business which affords matter for the newspapers, and that the important affairs of Government being seldom immediately made known, the correspondents have little to write about except the balls, picnics, croquet, and badminton parties, flirtations and rumoured engagements, all of which assume exaggerated importance in the eyes of those who discuss them. But Simla is no Castle of Indolence—

"Most of the English in India, be they civilians, staff officers, educationalists, surgeons, merchants, missionaries, or editors, are compelled to live very laborious days whether they may scorn delights or not. . . . . To compel the Supreme Government to remain nearly all the year in the unhealthy delta of the Ganges would be to burden it with a good deal more than the straw which breaks the camel's back."

We must, however, not forget that this book is essentially one of travel. The author had a great wish to visit some of the hill stations of the Himalayas, but on reaching these the glimpses caught of distant peaks appears to have had an irresistible fascination, and he accordingly proceeded to make preparations for a somewhat lengthy excursion in these grandest of all mountainous regions. His first journey lay along the famous Hindustan and Tibet road—a highway which though constructed at great expense has unfortunately entirely failed in its object of serving to attract the through trade between Tibet and India. The road, though fallen into disuse, is favourably compared by the author to the native paths of the Inner Himalayas, but the terrible accidents which have occurred (principally to equestrians) at various points along it, prove that those who traverse it need the utmost nerve. At Pangay the road comes to an end, and the author then ascended the valley of the Sutlej to Pu, where a severe attack of dysentery prostrated him for three weeks. Happily Pu is the residence of a Moravian missionary, and from his wife Mr. Wilson was enabled to procure medicines. But the visitors who frequented the vicinity of his tent appear to have helped to keep him in a state of uneasiness; at one time it was a bevy of Tartar Pilgrims who kept up a howling through the whole of a weary night; at another time he was awakened by a Tibetan mastiff fumbling at his throat to see if it was cold enough for his purposes, while on another occasion a formidable specimen of the *ursus isabellinus*, or snow-bear, was discovered making a supper off an apricot tree within sight of the author's bed. However, Mr. Wilson eventually recovered, and after surmounting the Kungma Pass (16,000 feet), Chinese Tibet was eventually reached at Shipki, the frontier town on which devolves the duty of turning back travellers The absurd difficulties which delayed the pitching of the tents, the good-humoured hostility of the Tartar women in their jack boots, and the unsuccessful efforts made by the author to penetrate further into Tibet, are all well worth reading. We cannot help thinking that he goes somewhat out of his way to find a cause for the exclusion of strangers in the possibility of Tibetan gold attracting the cupidity of lawless English and Americans. The arguments of the Shipki people, when interrogated by the author's companion, was that England having once got a

* *The Abode of Snow.* Observations on a Journey from Chinese Tibet to the Indian Caucasus through the upper valleys of the Himalaya. By Andrew Wilson. London (Blackwood), 1875.

pied-à-terre for commerce always finished up with annexation. This argument tallies exactly with that made use of a century ago by the Teshu Lama on the occasion of Mr. Bogle's mission to him. It appears to us a very sufficient reason for the fears of the Chinese Tibetan, though those who know more of our modern policy may see its groundlessness.

From Shipki Mr. Wilson's route was an extremely interesting one, traversing as it did the line of the Western Himalaya, in the interior of its ranges, at an average height of 12,000 feet, through the provinces of Hangrang, Spiti, Lahaul, Zanskar, Sum and Dras. Some of these regions are very little known, the district of Zanskar in particular claiming attention on account of the extraordinarily fantastic appearance of its precipitous mountains, the complexity of its geological systems, and, above all, the apparently close, though startling, connection between its people and the Scottish Highlanders. The author's route from thence into Kashmir lay across the Omba Pass, the height of which is about 14,500 feet, and the difficulties of which are graphically described. His remarks on Kashmir, its inhabitants, its ruler, and its regulations for the entertainment of European visitors are amusingly criticized.

We have not space to follow the author in any detail in his journey *viâ* the military station of Abbotabad to the British frontier at Torbela, in his excursion thence across the Indus into the fighting city of Kubbul, a nest of red-handed criminals, in most cases fugitives from English justice, and, lastly, in his journey to the Khyber Pass. We feel confident, however, that the reader who has got so far will not omit even a portion of the narrative before him, for Mr. Wilson's book is emphatically one of those which once commenced carries the reader along irresistibly to its very last page.

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DAS DEUTSCHE REICH IN GEOGRAPHISCHER, STATISTISCHER UND TOPOGRAPHISCHER BEZIEHUNG, Von *Gustav Neumann*. Zweite Auflage der "Geographie des Preussischen Staates," Berlin, 1875, Otto Müller, 2 vols. in 4. 8vo.

THIS is a new edition of the author's *Geographie des Preussischen Staates*, which the altered circumstances of the German Empire has rendered necessary. It now embraces, as the title expresses, the whole of the German Empire. As a topography of the Empire, it is the most perfect work yet published, always reliable in what it states, even though occasionally defective in minor details. Its statistics, too, are no less carefully brought together, and consequently, it is very popular in Germany, one of its elements of that popularity being its issue in twenty-five cheap numbers, and in four half volumes.

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DIE INSELN DES STILLEN OCEANS, EINE GEOGRAPHISCHE MONOGRAPHIE. Von *Dr. C. E. Meinicke*. 1 Theil. Leipzig (P. Frohberg). London (Trübner & Co.).

DR. MEINICKE is a great authority on Australia and the islands of the Pacific, to which he has devoted his attention during the last fifty years. The first volume of his latest work on this subject is now before us. It is a most careful compilation, and may be consulted with confidence, for the researches of travellers of all nations have been embodied in it. A chapter on the islands of the Pacific and their inhabitants in general, is succeeded by detailed accounts of Melanesia (including New Guinea) and New Zealand. A second volume will treat on Polynesia. Dr. Meinicke has been careful to give the native names, wherever they have been ascertained, as well as the nomenclature of European navigators. There is no map, but we trust one will be published with the second volume.

Log Book.

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The Arctic Expedition.—H. M. S. 'Valorous' arrived at Plymouth on the 29th August, with news of the progress of the Arctic Expedition up to July 17th, when the 'Alert' and 'Discovery' were last seen sailing down the Waigat. They will have reached Upernivik on or about the 20th, and are now, we trust, at or near the base of their operations in winter quarters. In our next number we shall give a complete account of the expedition and of its prospects, as well as a narrative of the perilous and important return voyage of H. M. S. 'Valorous.'

Archæological Survey of Southern India.—The valuable archæological researches of General Cunningham in the north, and of Mr. Burgess in the west of India, are now likely to be supplemented by the organization of an archæological survey of the southern portion of the peninsula. It is unnecessary to do more than allude to the great importance of such an examination of the numerous records and monuments of the Dravidian provinces, and to the flood of light which would thereby be shed on the customs, languages, and history of the inhabitants. The importance of the project, which was warmly supported at the recent Oriental Congress, has been fully recognized by the Secretary of State for India, and he has now commended the whole subject to the Government of India for early consideration.

Connection between variation of Solar Spots and other Meteorological Phenomena.—Mr. H. F. Blanford, meteorological reporter to the Government of India, has recently read a paper before the Asiatic Society of Bengal, in which he contends for the truth of certain old speculations that the sun's heat varies from year to year to such an extent as appreciably to affect terrestrial phenomena. Registers of the readings of a maximum black bulb thermometer were commenced at a few stations in Bengal in 1867 or 1868, and at others observations were begun in subsequent years. It was found necessary to eliminate as far as possible from the individual registers the irregularities due to variations in the state of the sky, and this can be done but very imperfectly. From actinometric observations instituted by various scientific men, it results that with a vertical sun and a sky free from all visible cloud or haze, the proportion of solar heat that penetrates the whole thickness of the atmosphere does not amount to more than two-thirds or three-fourths of that which reaches the exterior of our atmosphere. But in India, on cloudless days, the atmosphere is not nearly so diathermanous, and it is probable that not less than half the solar radiation is absorbed by it. From a consideration of the observations taken when the sky was either cloudless or nearly so, at 10 A.M. and 4 P.M., together with the two highest readings recorded in each month, Mr. Blanford has obtained results which agree in showing a very decided variation of the incident solar heat, a variation which approximately in the epoch of its maximum, its rapid rise before that maximum and slower decline after it, agrees with the variation curve of the solar spots. The importance of this discovery lies in the fact that if the sun's radiation vary directly with the number of spots and prominences every other meteorological phenomenon must likewise so vary, rainfall and temperature included. With regard to rainfall, the coincidence of its variation with that of the sun spots has been only partially verified by the data, but seeing that the rainfall of the larger part of the world has not been taken into consideration, this is no more than we should expect. A vast train of enquiry is opened up by the fact, if once established, that the solar heat undergoes periodical variation, and

although it now appears improbable that any steps will be taken to establish a solar observatory at Simla, such as was recently talked of, yet their importance affords a strong incentive for the institution of continuous observations of solar phenomena in tropical countries so well adapted for the purpose as India.

The Eucalyptus Globulus.—M. Cosson has communicated to the Paris Geographical Society a note on the subject of the *Eucalyptus globulus* (or blue gum tree, as it is termed in Australia) and the success which has attended its acclimatization in other countries. Although discovered in 1791, it was not till 1854 that it was known beyond the precincts of botanic gardens. M. Ramel, who happened to see some fine specimens in the Melbourne Gardens, was much struck with them, and ascertained from Baron de Müller, the director, that the tree was an excellent fever-dispelling agent, was easily acclimatized, rapid of growth, and afforded capital timber for shipbuilding. Chiefly through the help of the Acclimatization Society and the Museum of Natural History at Paris and the Experimental Gardens in Algiers, the tree has been successfully introduced into Southern France, Corsica, Algeria, Spain, Portugal, Egypt, Senegal, Madagascar, Reunion, the Cape, Guiana, Guadeloupe, Tahiti, India, New Caledonia, and other places. In Algeria the experiment has proved most successful. At Aïn-Mokra, on the banks of Lake Fezzara, the few inhabitants were almost decimated by marsh fevers, and the rich iron mines of Mokta adjoining were in consequence abandoned in summer; some hundreds of trees planted on the shores of the lake have rendered the place quite healthy, and enabled the mines to be worked. It has also been ascertained that an infusion made from the leaves, as well as the leaves powdered, the extract and essential oil are all valuable therapeutics.

Exploration in Iceland.—Mr. W. L Watts, author of *Iceland: its Jökulls and Fjalls*, has successfully, though not without fatigue, accomplished the task he announced his intention of setting himself, *i.e.*, that of exploring Vatna Yökull, a mountain covered with snow and ice in the south-east of the island. Last year Mr. Watts had ascended the Vatna to the height of 6000 feet, and this year he has completed his examination of it and of the volcanoes to the north of it, in eighteen days. He has satisfied himself that the Vatna is the highest mountain in Iceland, and appears to incline to the belief that volcanic action is increasing to the extent of the ice-covered mountains of Iceland, and that a gradual assimilation to the orography and physical geography of Greenland will thus take place.

The Amazons Valley.—In April last Don Rafael Reyes, a New Granadian, arrived at Manáos (the capital of the Brazilian province of the Amazons) from Popagan, by way of the River Içá, on which he hopes to start steam navigation. He reports the Içá free from rapids and with a sandy bed; it is, however, somewhat shallow in the dry season, so that vessels should not draw more than 4 feet of water. Don Rafael's "port of embarkation" on the Içá is stated to be only 25 leagues from Popagan, which seems almost impossibly short; perhaps it should be from Pasto.

In April also Captain Andrea started from Manáos up the river Purús, bound for its affluent the Aquiry, from which he purposes to open a road to Bolivia. Captain Andrea takes with him a well-armed party to resist Indian attacks, and from what is known of him it is believed he will use every effort to succeed in his difficult enterprise. By *Bolivia* is probably meant the Bolivian settlements on the river Mamoré (as the Aquiry itself, south of lat. 10° 20′ S., must be in Bolivia): but to reach these the great river Beni has to be crossed.

Obituary.—COMMODORE J. G. GOODENOUGH, C.B., C.M.G. We regret to have to record the death of this able and gallant naval officer, who was treacherously murdered while endeavouring to open friendly intercourse with the natives of Santa Cruz Island, one of the Solomon Group. We have had occasion more than once to refer in these columns to the services rendered by Commodore Goodenough, and we propose in our October number to give a fuller account of his distinguished career.

Correspondence.

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MR. SKERTCHLY ON THE OGOWÉ.

To the Editor of the "GEOGRAPHICAL MAGAZINE."

SIR,—Your August number contained a strongly worded contradiction of the account of a journey stated to have been performed by me, which appeared in the *Academy* of May 1st. Upon reading this I immediately turned to the pages of that journal, where to my surprise I found that I was credited with having paid a visit to one of the Central African Lakes in 1868. Enquiry as to the source of this article elicited the fact that the *Academy* obtained it from a regular contributor, who, some short time previously, had had a few minutes' conversation with me on Equatorial Africa, but who was entirely erroneous in his statements as to *my* having *visited* the localities mentioned, and who had no authority whatever from me to publish them, since such a thing was quite against my desire.

The facts of the case are as follows:—

In 1870, not 1868 (when, for Mr. Walker's benefit, I state that I was in Australia), I paid a visit to the Gaboon for the purpose of making zoological collections. In the course of a journey to the eastward of the high land wherein the River Remboe takes its rise, I fell in with a man of Arab descent, who had lately come from the interior with slaves and ivory, and was going to the Congo mouth. In the course of several conversations I had with him, he told me that at so many days' (I forget the exact number) journey due east, there was a river as large as the Remboe at Chinchua (about a mile wide), which flowed to the right (south), and that this river entered the sea at the Congo, and that boats could go from it to the Ogowai through the network of lagoons with which the country is covered. So many days beyond this river, still going east, but with a little northing, there was a range of mountains, one of which "smoked" beyond which again there was a large lake, so broad that when the wind blew strongly, the waves were so high as to endanger the safety of the canoes upon it, or even to prevent them being launched; while in crossing it land was lost sight of for a short time. From the distance he said he could pass over on each successive day, I estimated the river to be in about 12° E. long., while the lake by the same calculation would be in about 15° E. long. Since then I have anxiously looked out for news of this region from the Congo Expedition, but have hitherto refrained from making a mere report public.

Such was the account I received from Oblimba, and which I gave the gentleman who unfortunately published it in the *Academy*, crediting me with having *visited* a region of which I knew nothing except by *report*, and which drew forth the remarks of Mr. R. B. N. Walker.

As regards sundry remarks in Mr. Walker's letter, I only reply that *he* knows that it was impossible for me to see him earlier than I did, and that he gave me *no* information respecting the Ogowai. Finally as to the Arabs, there were two living within a few yards of his factory who were accustomed to make the journey between the Gaboon and Ogowai, of which he speaks so eulogistically, several times a year.—I am, &c.,

J. S. SKERTCHLY, F.R.G.S.

THE ARCTIC EXPLORERS.

To the Editor of the "GEOGRAPHICAL MAGAZINE."

MONSIEUR,—Permettez-moi de vous adresser ces quelques vers dédiés aux explorateurs du Pôle Nord. Ils ont été chantés dans le dernier Banquet du Caveau* aux applaudissements de tous les Convives, heureux de donner ainsi un témoignage d'admiration et de reconnaissance au Peuple Anglais, qui vient de se montrer si généreux, dernièrement encore, en faveur de nos pauvres inondés du midi.

Eu égard à l'intention, j'ose espérer, Monsieur, que vous voudrez bien excuser ma démarche, et agréer l'assurance de ma parfaite consideration.

EUGÈNE GARRAUD,
Pensionnaire de la Comedie Française.

AUX EXPLORATEURS DU POLE NORD.

Amis, ce soir, je vous convie
A porter un toast aux Anglais,
Toujours prêts à risquer leur vie,
Pour la science et ses progrès.
Pour faire grand, rien ne leur coûte;
Hier, sont partis bord-à-bord,
Leurs vaisseaux, qui du Pôle Nord,
Au monde vont frayer la route.

Je bois à vous, navigateurs,
Au succès de votre entreprise,
Au peuple qui la favorise,
A vos premiers explorateurs.

L'expédition valeureuse,
Qu'une fois encor vous tentez,
Sera peut-être désastreuse,
Il n'importe: heureux vous partez;
Si vous courez à votre perte,
En cherchant ces froids horizons!
Vous immortalisez les noms,
De l' 'Alerte' et la 'Découverte.'

A votre but, navigateurs,
Cœurs vaillants remplis d'espérance,
Marchez avec persévérance,
A l'œuvre! hardis explorateurs.

Si vous visitez le rivage,
Où Franklin et ses compagnons
Sont tous morts, luttant de courage,
Contre les âpres aquilons;
Si vous rencontrez dans les glaces,
Ce funeste et mouvant îlot,
D'où notre courageux Bellot,
Disparut sans laisser de traces,

Découvrez-vous, navigateurs,
Pour ce noble enfant de la France,
Pour ces martyrs de la science,
Priez, pour ces explorateurs!

Au retour de vos traversées,
Vous trouverez dans vos foyers,
Par la gloire, pour vous tressées,
Des couronnes de verts lauriers:
Les nations, l'âme attendrie,
Diront vos noms avec fierté,
Ceux qui servent l'humanité,
Ont tout l'Univers pour Patrie.

Salut à vous, navigateurs,
Fils de la science féconde,
Salut à vous, héros de l'Onde,
Salut, aux grands explorateurs.

10 Juillet 1875.

EUGÈNE GARRAUD.

* A literary club of Paris, of which Béranger, and other French song writers, have benn members.—*Ed.*

Proceedings of Geographical Societies.

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BRITISH ASSOCIATION.

SECTION E.

Thursday, August 26th.

THE Geographical Section (E) met in the Blind Asylum, Bristol, on the above date, when Lieut.-General R. Strachey, R.E., C.S.I., F.R.S., took the chair. Vice-President Sir J. F. Davis, Bart., K.C.B., F.R.S., F.R.G.S. Secretaries, H. W. Bates, Esq., E. C. Rye, Esq., and F. F. Tuckett, Esq.

THE PRESIDENT'S ADDRESS.

The President commenced by alluding to the various lights in which geography had been viewed in the previous addresses of his predecessors. He then continued as follows:—

Following, then, a somewhat different path from those who have gone before me in treating of geography, I propose to speak of the physical causes which have impressed on our planet the present outlines and forms of its surface, have brought about its present conditions of climate, and have led to the development and distribution of the living beings found upon it.

In selecting this subject for my opening remarks, I have been not a little influenced by a consideration of the present state of geographical knowledge, and of the probable future of geographical investigation. It is plain that the field for mere topographical exploration is already greatly limited, and that it is continually becoming more restricted. Although no doubt much remains to be done in obtaining detailed maps of large tracts of the earth's surface, yet there is but comparatively a very small area with the essential features of which we are not now fairly well acquainted. Day by day our maps become more complete, and with our greatly improved means of communication the knowledge of distant countries is constantly enlarged and more widely diffused. Somewhat in the same proportion the demands for more exact information become more pressing. The necessary consequence is an increased tendency to give to geographical investigations a more strictly scientific direction. In proof of this I may instance the fact that the two British naval expeditions now being carried on, that of the 'Challenger' and that of the Arctic seas, have been organized almost entirely for general scientific research, and comparatively little for topographical discovery. Narratives of travels, which not many years ago might have been accepted as valuable contributions to our then less perfect knowledge, would now perhaps be regarded as superficial and insufficient. In short, the standard of knowledge of travellers and writers on geography must be raised to meet the increased requirements of the time.

Other influences are at work tending to the same result. The great advance made in all branches of natural science limits more and more closely the facilities for original research, and draws the observer of nature into more and more special studies, while it renders the acquisition by any individual of the highest standard of knowledge in more than one or two special subjects comparatively difficult and rare. At the same time the mutual interdependence of natural phenomena daily becomes more apparent; and it is of ever-increasing importance that there shall be some among the cultivators of natural knowledge who specially direct their attention to the general relations existing among all the

forces and phenomena of nature. In some important branches of such subjects, it is only through study of the local physical conditions of various parts of the earth's surface and the complicated phenomena to which they give rise, that sound conclusions can be established; and this study constitutes Physical or Scientific Geography. It is very necessary to bear in mind that a large portion of the phenomena dealt with by the sciences of observation relates to the earth as a whole in contradistinction to the substances of which it is formed, and can only be correctly appreciated in connection with the terrestrial or geographical conditions of the place where they occur. On the one hand, therefore, while the proper prosecution of the study of Physical Geography requires a sound knowledge of the researches and conclusions of students in the special branches of science, on the other success is not attainable in the special branches without suitable apprehension of geographical facts. For these reasons it appears to me that the general progress of science will involve the study of geography in a more scientific spirit, and with a clearer conception of its true function, which is that of obtaining accurate notions of the manner in which the forces of nature have brought about the varied conditions characterizing the surface of the planet which we inhabit.

In its broadest sense science is organized knowledge, and its methods consist of the observation and classification of the phenomena of which we become conscious through our senses, and the investigation of the causes of which these are the effects. The first step in geography, as in all other sciences, is the observation and description of the phenomena with which it is concerned; the next is to classify and compare this empirical collection of facts, and to investigate their antecedent causes. It is in the first branch of the study that most progress has been made, and to it indeed the notion of geography is still popularly limited. The other branch is commonly spoken of as physical geography, but it is more correctly the science of geography.

The progress of geography has thus advanced from first rough ideas of relative distance between neighbouring places, to correct views of the earth's form, precise determinations of position, and accurate delineations of the surface. The first impressions of the differences observed between distant countries were at length corrected by the perception of similarities no less real. The characteristics of the great regions of polar cold and equatorial heat, of the sea and land, of the mountains and plains, were appreciated; and the local variations of season and climate, of wind and rain, were more or less fully ascertained. Later, the distribution of plants and animals, their occurrence in groups of peculiar structure in various regions, and the circumstances under which such groups vary from place to place gave rise to fresh conceptions. Along with these facts were observed the peculiarities of the races of men —their physical form, languages, customs, and history— exhibiting on the one hand striking differences in different countries, but on the other often connected by a strong stamp of similarity over large areas.

By the gradual accumulation and classification of such knowledge the scientific conception of geographical unity and continuity was at length formed, and the conclusion established that while each different part of the earth's surface has its special characteristics, all animate and inanimate nature constitutes one general system, and that the particular features of each region are due to the operation of universal laws acting under varying local conditions. It is upon such a conception that is now brought to bear the doctrine, very generally accepted by the naturalists of our own country, that each successive phase of the earth's history, for an indefinite period of time, has been derived from that which preceded it, under the operation of the forces of nature as we now find them; and that, so far as observation justifies the adoption of any conclusions on such subjects, no change has ever taken place in those forces, or in the properties of matter. This doctrine is commonly spoken of as the doctrine of evolution, and it is to its application to geography that I wish to direct your attention.

I desire here to remark that in what I am about to say I altogether leave on one side all questions relating to the origin of matter, and of the so-called forces of nature which give rise to the properties of matter. In the present state of knowledge such subjects are, I conceive, beyond the legitimate field of physical science, which is limited to discussions directly arising on facts within the reach of observation, or on reasonings based on such facts. It is a necessary condition of the progress of knowledge that the line between what properly is or is not within the reach of human intelligence is ill-defined, and that opinions will vary as to where it should be drawn; for it is the avowed and successful aim of science to keep this line constantly shifting by pushing it forward; many of the efforts made to do this are no doubt founded in error, but all are deserving of respect that are undertaken honestly.

The conception of evolution is essentially that of a passage to the state of things which observation shows us to exist now, from some preceding state of things. Applied to geography, that is to say to the present condition of the earth as a whole, it leads up to the conclusion that the existing outlines of sea and land have been caused by modifications of pre-existing oceans and continents, brought about by the operation of forces which are still in action, and which have acted from the most remote past of which we can conceive; that all the successive forms of the surface,—the depressions occupied by the waters, and the elevations constituting mountain-chains,—are due to these same forces; that these have been set up, first, by the secular loss of heat which accompanied the original cooling of the globe, and second, by the annual or daily gain and loss of heat received from the sun acting on the matter of which the earth and its atmosphere are composed; that all variations of climate are dependent on differences in the condition of the surface; that the distribution of life on the earth, and the vast varieties of its forms, are consequences of contemporaneous or antecedent changes of the forms of the surface and climate; and thus that our planet as we now find it is the result of modifications gradually brought about in its successive stages, by the necessary action of the matter out of which it has been formed, under the influence of the matter which is external to it.

I shall state briefly the grounds on which these conclusions are based.

So far as concerns the inorganic fabric of the earth, that view of its past history which is based on the principle of the persistence of all the forces of nature, may be said to be now universally adopted. This teaches that the almost infinite variety of natural phenomena arises from new combinations of old forms of matter, under the action of new combinations of old forms of force. Its recognition has, however, been comparatively recent, and is in a great measure due to the teachings of that eminent geologist, the late Sir Charles Lyell, whom we have lost during the past year.

When we look back by the help of geological science to the more remote past, through the epochs immediately preceding our own, we find evidence of marine animals—which lived, were reproduced, and died—possessed of organs proving that they were under the influence of the heat and light of the sun; of seas whose waves rose before the winds, breaking down cliffs, and forming beaches of boulders and pebbles; of tides and currents spreading out banks of sand and mud, on which are left the impress of the ripple of the water, of drops of rain, and of the track of animals; and

all these appearances are precisely similar to those we observe at the present day as the result of forces which we see actually in operation. Every successive stage, as we recede in the past history of the earth, teaches the same lesson. The forces which are now at work, whether in degrading the surface by the action of seas, rivers, or frosts, and in transporting its fragments into the sea, or in reconstituting the land by raising beds laid out in the depth of the ocean, are traced by similar effects as having continued in action from the earliest times.

Thus pushing back our inquiries we at last reach the point where the apparent cessation of terrestrial conditions such as now exist requires us to consider the relation in which our planet stands to other bodies in celestial space; and vast though the gulf be that separates us from these, science has been able to bridge it. By means of spectroscopic analysis it has been established that the constituent elements of the sun and other heavenly bodies are substantially the same as those of the earth. The examination of the meteorites which have fallen on the earth from the interplanetary spaces, shows that they also contain nothing foreign to the constituents of the earth. The inference seems legitimate, corroborated as it is by the manifest physical connection between the sun and the planetary bodies circulating around it, that the whole solar system is formed of the same descriptions of matter, and subject to the same general physical laws. These conclusions further support the supposition that the earth and other planets have been formed by the aggregation of matter once diffused in space around the sun; that the first consequence of this aggregation was to develop intense heat in the consolidating masses; that the heat thus generated in the terrestrial sphere was subsequently lost by radiation; and that the surface cooled and became a solid crust, leaving a central nucleus of much higher temperature within. The earth's surface appears now to have reached a temperature which is virtually fixed, and on which the gain of heat from the sun is, on the whole, just compensated by the loss by radiation into surrounding space.

Such a conception of the earliest stage of the earth's existence is commonly accepted, as in accordance with observed facts. It leads to the conclusion that the hollows on the surface of the globe occupied by the ocean, and the great areas of dry land, were original irregularities of form caused by unequal contraction; and that the mountains were corrugations, often accompanied by ruptures, caused by the strains developed in the external crust by the force of central attraction exerted during cooling, and were not due to forces directly acting upwards generated in the interior by gases or otherwise. It has recently been very ably argued by Mr. Mallet that the phenomena of volcanic heat are likewise consequences of extreme pressures in the external crust, set up in a similar manner, and are not derived from the central heated nucleus.

There may be some difficulty in conceiving how forces can have been thus developed sufficient to have produced the gigantic changes which have occurred in the distribution of land and water over immense areas, and in the elevation of the bottoms of former seas so that they now form the summits of the highest mountains, and to have effected such changes within the very latest geological epoch. These difficulties in great measure arise from not employing correct standards of space and time in relation to the phenomena. Vast though the greatest heights of our mountains and depths of our seas may be, and enormous though the masses which have been put into motion, when viewed according to a human standard, they are insignificant in relation to the globe as a whole. Such heights and depths (about 6 miles) on a sphere of 10 feet in diameter would be represented on a true scale by elevations and depressions of less than the tenth part of an inch, and the average elevation of the whole of the dry land (about 1000 feet) above the mean level of the surface would hardly amount to the thickness of an ordinary sheet of paper. The forces developed by the changes of the temperature of the earth as a whole must be proportionate to its dimensions; and the results of their action on the surface in causing elevations, contortions, or disruptions of the strata, cannot be commensurable with those produced by forces having the intensities, or by strains in bodies of the dimensions, with which our ordinary experience is conversant.

The difficulty in respect to the vast extent of past time is perhaps less great, the conception being one with which most persons are now more or less familiar. But I would remind you, that great though the changes in human affairs have been since the most remote epochs of which we have records in monuments or history, there is nothing to indicate that within this period has occurred any appreciable modification of the main outlines of land and sea, or of the conditions of climate, or of the general characters of living creatures; and that the distance that separates us from those days is as nothing when compared to the remoteness of past geological ages. No useful approach has yet been made to a numerical estimate of the duration even of that portion of geological time which is nearest to us; and we can say little more than that the earth's past history extends over hundreds of thousands or millions of years.

The solid nucleus of the earth with its atmosphere, as we now find them, may thus be regarded as exhibiting the residual phenomena which have resulted on its attaining a condition of practical equilibrium, the more active process of aggregation having ceased, and the combination of its elements into the various solid, liquid, or gaseous matters found on or near the surface having been completed. During its passage to its present state many wonderful changes must have taken place, including the condensation of the ocean, which must have long continued in a state of ebullition, or bordering on it, surrounded by an atmosphere densely charged with watery vapour. Apart from the movements in its solid crust caused by the general cooling and contraction of the earth, the higher temperature due to its earlier condition hardly enters directly into any of the considerations that arise in connection with its present climate, or with the changes during past time which are of most interest to us; for the conditions of climate and temperature at present, as well as in the period during which the existence of life is indicated by the presence of fossil remains, and which have affected the production and distribution of organized beings, are dependent on other causes, to a consideration of which I now proceed.

The natural phenomena relating to the atmosphere are often extremely complicated and difficult of explanation; and meteorology is the least advanced of the branches of physical science. But sufficient is known to indicate, without possible doubt, that the primary causes of the great series of phenomena, included under the general term climate, are the action and reaction of the mechanical and chemical forces set in operation by the sun's heat, varied from time to time and from place to place by the influence of the position of the earth in its orbit, of its revolution on its axis, of geographical position, elevation above the sea-level, and condition of the surface, and by the great mobility of the atmosphere and the ocean.

The intimate connection between climate and local geographical conditions is everywhere apparent; nothing is more striking than the great differences between neighbouring places where the effective local conditions are not alike, which often far surpass the contrasts attending the widest separation possible on the globe. Three or four miles of vertical height produce effects almost equal to those of transfer from the equator

to the poles. The distribution of the great seas and continents give rise to periodical winds—the trades and monsoons—which maintain their general characteristics over wide areas, but present almost infinite local modifications whether of season, direction, or force. The direction of the coasts and their greater or less continuity greatly influence the flow of the currents of the ocean; and these, with the periodical winds, tend on the one hand to equalize the temperature of the whole surface of the earth, and on the other to cause surprising variations within a limited area. Ranges of mountains, and their position in relation to the periodical or rain-bearing winds, are of primary importance in controlling the movements of the lower strata of the atmosphere, in which, owing to the laws of elastic gases, the great mass of the air and watery vapour are concentrated. By their presence they may either constitute a barrier across which no rain can pass, or determine the fall of torrents of rain around them. Their absence or their unfavourable position, by removing the causes of condensation, may lead to the neighbouring tracts becoming rainless deserts.

The difficulties that arise in accounting for the phenomena of climate on the earth as it now is, are naturally increased when the attempt is made to explain what is shown by geological evidence to have happened in past ages. The disposition has not been wanting to get over these last difficulties by invoking supposed changes in the sources of terrestrial heat, or in the conditions under which heat has been received by the earth, for which there is no justification in fact, in a manner similar to that in which violent departures from the observed course of nature have been assumed to account for some of the analogous mechanical difficulties.

Among the most perplexing of such climatal problems are those involved in the former extension of glacial action of various sorts over areas which could hardly have been subject to it under existing terrestrial and solar conditions; and in the discovery, conversely, of indications of far higher temperatures at certain places than seems compatible with their high latitudes; and in the alternations of such extreme conditions. The true solution of these questions has apparently been found in the recognition of the disturbing effects of the varying eccentricity of the earth's orbit, which, though inappreciable in the comparatively few years to which the affairs of men are limited, become of great importance in the vastly increased period brought into consideration when dealing with the history of the earth. The changes of eccentricity of the orbit are not of a nature to cause appreciable differences in the mean temperature either of the earth generally or of the two hemispheres; but they may, when combined with changes of the direction of the earth's axis caused by the precession of the equinoxes and nutation, lead to exaggeration of the extremes of heat and cold, or to their diminution; and this would appear to supply the means of explaining the observed facts, though doubtless the detailed application of the conception will long continue to give rise to discussions. Mr. Croll, in his book entitled *Climate and Time*, has recently brought together, with much research, all that can now be said on this subject; and the general correctness of that part of his conclusions which refers to the periodical occurrence of epochs of greatly increased winter cold and summer heat in one hemisphere, combined with a more equable climate in the other, appears to me to be fully established.

These are the considerations which are held to prove that the inorganic structure of the globe through all its successive stages—the earth beneath our feet, with its varied surface of land and sea, mountain and plain, and with its atmosphere which distributes heat and moisture over that surface,—has been evolved as the necessary result of the original aggregation of matter at some extremely remote period, and of the subsequent modification of that matter in condition and form under the exclusive operation of invariable physical forces.

From these investigations we carry on the inquiry to the living creatures found upon the earth; what are their relations one to another, and what to the inorganic world with which they are associated?

This inquiry first directed to the present time, and thence carried backwards as far as possible into the past, proves that there is one general system of life, vegetable and animal, which is co-extensive with the earth as it now is, and as it has been in all the successive stages of which we obtain a knowledge by geological research. The phenomena of life, as thus ascertained, are included in the organization of living creatures, and their distribution in time and place. The common bond that subsists between all vegetables and animals is testified by the identity of the ultimate elements of which they are composed. These elements are carbon, oxygen, hydrogen, and nitrogen, with a few others in comparatively small quantities; the whole of the materials of all living things being found among those that compose the inorganic portion of the earth.

The close relation existing between the least specialized animals and plants, and between these and organic matter not having life, and even with inorganic matter, is indicated by the difficulty that arises in determining the nature of the distinctions between them. Among the more highly developed members of the two great branches of living creatures, the well-known similarities of structure observed in the various groups indicate a connection between proximate forms which was long seen to be akin to that derived through descent from a common ancestor by ordinary generation.

The facts of distribution show that certain forms are associated in certain areas, and that as we pass from one such area to another the forms of life change also. The general assemblages of living creatures in neighbouring countries easily aceessible to one another, and having similar climates, resemble one another; and much in the same way, as the distance between areas increases, or their mutual accessibility diminishes, or the conditions of climate differ, the likeness of the forms within them becomes continually less apparent. The plants and animals existing at any time in any locality tend constantly to diffuse themselves around that local centre, this tendency being controlled by the conditions of climate, &c., of the surrounding area, so that under certain unfavourable conditions diffusion ceases.

The possibilities of life are further seen to be everywhere directly influenced by all external conditions, such as those of climate, including temperature, humidity, and wind; of the length of the seasons and days and nights; of the character of the surface whether it be land or water, and whether it be covered by vegetation or otherwise; of the nature of the soil; of the presence of other living creatures, and many more. The abundance of forms of life in different areas (as distinguished from number of individuals) is also found to vary greatly, and to be related to the accessibility of such areas to immigration from without; to the existence, within or near the areas, of localities offering considerable variations of the conditions that chiefly affect life; and to the local climate and conditions being compatible with such immigration.

For the explanation of these and other phenomena of organization and distribution, the only direct evidence that observation can supply is that derived from the mode of propagation of creatures now living; and no other mode is known than that which takes place by ordinary generation, through descent from parent to offspring. It was left for the genius of Darwin to point out how the course of nature as it now acts in the reproduction of living creatures, is sufficient for the interpretation of what had previously been incomprehensible in these matters. He showed how propagation by descent

operates, subject to the occurrence of certain small variations in the offspring, and that the preservation of some of these varieties to the exclusion of others follows as a necessary consequence when the external conditions are more suitable to the preserved forms than to those lost. The operation of these causes he called Natural Selection. Prolonged over a great extent of time it supplies the long-sought key to the complex system of forms either now living on the earth, or the remains of which are found in the fossil state, and explains the relations among them, and the manner in which their distribution has taken place in time and space.

Thus we are brought to the conclusion that the directing forces which have been efficient in developing the existing forms of life from those which went before them, are those same successive external conditions, including both the forms of land and sea, and the character of the climate, which have already been shown to arise from the gradual modification of the material fabric of the globe as it slowly attained to its present state. In each succeeding epoch, and in each separate locality, the forms preserved and handed on to the future were determined by the general conditions of surface at the time and place; and the aggregate of successive sets of conditions over the whole earth's surface has determined the entire series of forms which have existed in the past, and have survived till now.

As we recede from the present into the past, it necessarily follows, as a consequence of the ultimate failure of all evidence as to the conditions of the past, that positive testimony of the conformity of the facts with the principle of evolution gradually diminishes, and at length ceases. In the same way positive evidence of the continuity of action of all the physical forces of nature eventually fails. But inasmuch as the evidence so far as it can be procured, supports the belief in this continuity of action, and as we have no experience of the contrary being possible, the only justifiable conclusion is, that the production of life must have been going on as we now know it, without any intermission, from the time of its first appearance on the earth. These considerations manifestly afford no sort of clue to the origin of life. They only serve to take us back to a very remote epoch, when the living creatures differed greatly in detail from those of the present time, but had such resemblances to them as to justify the conclusion that the essence of life then was the same as now; and through that epoch into an unknown anterior period, during which the possibility of life, as we understand it, began, and from which has emerged in a way that we cannot comprehend, matter with its properties, bound together by what we call the elementary physical forces. There seems to be no foundation in any observed fact for suggesting that the wonderful property which we call life appertains to the combinations of elementary substances in association with which it is exclusively found, otherwise than as all other properties appertain to the particular forms or combinations of matter with which they are associated. It is no more possible to say how originated or operates the tendency of some sorts of matter to take the form of vapours, or fluids, or solid bodies, in all their various shapes, or for the various sorts of matter to attract one another or combine, than it is to explain the origin in certain forms of matter of the property we call life, or the mode of its action. For the present, at least, we must be content to accept such facts as the foundation of positive knowledge, and from them to rise to the apprehension of the means by which nature has reached its present state, and is advancing into an unknown future.

These conceptions of the relations of animal and vegetable forms to the earth in its successive stages lead to views of the significance of type (*i.e.* the general system of structure running through various groups of organized beings) very different from those under which it was held to be an indication of some occult power directing the successive appearance of living creatures on the earth. In the light of evolution, type is nothing more than the direction given to the actual development of life by the surface-conditions of the earth, which have supplied the forces that controlled the course of the successive generations leading from the past to the present. There is no indication of any inherent or prearranged disposition towards the development of life in any particular direction. It would rather appear that the actual face of nature is the result of a succession of apparently trivial incidents, which by some very slight alteration of local circumstances might often, it would seem, have been turned in a different direction. Some otherwise unimportant difference in the constitution or sequence of the substrata at any locality might have determined the elevation of mountains where a hollow filled by the sea was actually formed, and thereby the whole of the climatal and other conditions of a large area would have been changed, and an entirely different impulse given to the development of life locally, which might have impressed a new character on the whole face of nature.

But further, all that we see or know to have existed upon the earth has been controlled to its most minute details by the original constitution of the matter which was drawn together to form our planet. The actual character of all inorganic substances, as of all living creatures, is only consistent with the actual constitution and proportions of the various substances of which the earth is composed. Other proportions than the actual ones in the constituents of the atmosphere would have required an entirely different organization in all air-breathing animals, and probably in all plants. With any considerable difference in the quantity of water either in the sea or distributed as vapour, vast changes in the constitution of living creatures must have been involved. Without oxygen, hydrogen, nitrogen, or carbon, what we term life would have been impossible. But such speculations need not be extended.

The substances of which the earth is now composed are identical with those of which it has always been made up; so far as is known it has lost nothing and has gained nothing, except what has been added in extremely minute quantities by the fall of meteorites. All that is or ever has been upon the earth is part of the earth, has sprung from the earth, is sustained by the earth, and returns to the earth; taking back thither what it withdrew, making good the materials on which life depends, without which it would cease, and which are destined again to enter into new forms, and contribute to the ever onward flow of the great current of existence.

The progress of knowledge has removed all doubt as to the relation in which the human race stands to this great stream of life. It is now established that man existed on the earth at a period vastly anterior to any of which we have records in history or otherwise. He was the contemporary of many extinct mammalia at a time when the outlines of land and sea, and the conditions of climate over large parts of the earth, were wholly different from what they now are, and our race has been advancing towards its present condition during a series of ages for the extent of which ordinary conceptions of time afford no suitable measure. These facts have, in recent years, given a different direction to opinion as to the manner in which the great groups of mankind have become distributed over the areas where they are now found; and difficulties once considered insuperable become soluble when regarded in connection with those great alterations of the outlines of land and sea which are shown to have been going on up to the very latest geological periods. The ancient monuments of Egypt, which take us back perhaps 7000 years from the present time, indicate that when they were erected the neighbouring countries were in a condition of civilization not

very greatly different from that which existed when they fell under the dominion of the Romans or Muhammadans hardly 1500 years ago; and the progress of the population towards that condition can hardly be accounted for otherwise than by prolonged gradual transformations going back to times so far distant as to require a geological rather than an historical standard of reckoning.

Man, in short, takes his place with the rest of the animate world, in the advancing front of which he occupies so conspicious a position. Yet for this position he is indebted not to any exclusive powers of his own, but to the wonderful compelling forces of nature which have lifted him entirely without his knowledge, and almost without his participation, so far above the animals of whom he is still one, though the only one able to see or consider what he is.

For the social habits essential to his progress, which he possessed even in his most primitive state, man is without question dependent on his ancestors, as he is for his form and other physical peculiarities. In his advance to civilization he was insensibly forced, by the pressure of external circumstances, through the more savage condition, in which his life was that of the hunter, first to pastoral and then to agricultural occupations. The requirements of a population gradually increasing in numbers could only be met by a supply of food more regular and more abundant than could be provided by the chase. But the possibility of the change from the hunter to the shepherd or herdsman rested on the antecedent existence of animals suited to supply man with food, having gregarious habits, and fitted for domestication, such as sheep, goats, and horned cattle; for their support the social grasses were a necessary preliminary, and for the growth of these in sufficient abundance land naturally suitable for pasture was required. A further evasion of man's growing difficulty in obtaining sufficient food was secured by aid of the cereal grasses, which supplied the means by which agriculture, the outcome of pastoral life, became the chief occupation of more civilized generations. Lastly, when these increased facilities for providing food were in turn overtaken by the growth of the population, new power to cope with the recurring difficulty was gained through the cultivation of mechanical arts and of thought, for which the needful leisure was for the first time obtained when the earliest steps of civilization had removed the necessity for unremitting search after the means of supporting existence. Then was broken down the chief barrier in the way of progress, and man was carried forward to the condition in which he now is.

It is impossible not to recognize that the growth of civilization, by aid of its instruments, pastoral and agricultural industry, was the result of the unconscious adoption of defences supplied by what was exterior to man, rather than of any truly intelligent steps taken with forethought to attain it; and in these respects man, in his struggle for existence, has not differed from the humbler animals or from plants. Neither can the marvellous ultimate growth of his knowledge, and his acquisition of the power of applying to his use all that lies without him, be viewed as differing in anything but form or degree from the earlier steps in his advance. The needful protection against the foes of his constantly increasing race—the legions of hunger and disease, infinite in number, ever changing their mode of attack or springing up in new shapes—could only be attained by some fresh adaptation of his organization to his wants, and this has taken the form of that development of intellect which has placed all other creatures at his feet and all the powers of nature in his hand.

The picture that I have thus attempted to draw presents to us our earth carrying with it, or receiving from the sun or other external bodies, as it travels through celestial space, all the materials and all the forces by help of which are fashioned whatever we see upon it. We may liken it to a great complex living organism, having an inert substratum of inorganic matter on which are formed many separate organized centres of life, but all bound up together by a common law of existence, each individual part depending on those around it, and on the past condition of the whole. Science is the study of the relations of the several parts of this organism one to another, and of the parts to the whole. It is the task of the geographer to bring together from all places on the earth's surface the materials from which shall be deduced the scientific conception of nature. Geography supplies the rough blocks wherewith to build up that grand structure towards the completion of which science is striving. The traveller, who is the journeyman of science, collects from all quarters of the earth observations of fact, to be submitted to the research of the student, and to provide the necessary means of verifying the inductions obtained by study or the hypotheses suggested by it. If, therefore, travellers are to fulfil the duties put upon them by the division of scientific labour, they must maintain their knowledge of the several branches of science at such a standard as will enable them thoroughly to apprehend what are the present requirements of science, and the classes of fact on which fresh observation must be brought to bear to secure its advance. Nor does this involve any impracticable course of study. Such knowledge as will fit a traveller for usefully participating in the progress of science is now placed within the reach of every one. The lustre of that energy and self-devotion which characterize the better class of explorers will not be dimmed by joining to it an amount of scientific training which will enable them to bring away from distant regions enlarged conceptions of other matters besides mere distance and direction. How great is the value to science of the observations of travellers endowed with a share of scientific instruction is testified by the labours of many living naturalists. In our days this is especially true; and I appeal to all who desire to promote the progress of geographical science as explorers, to prepare themselves for doing so efficiently, while they yet possess the vigour and physical powers that so much conduce to success in such pursuits.

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